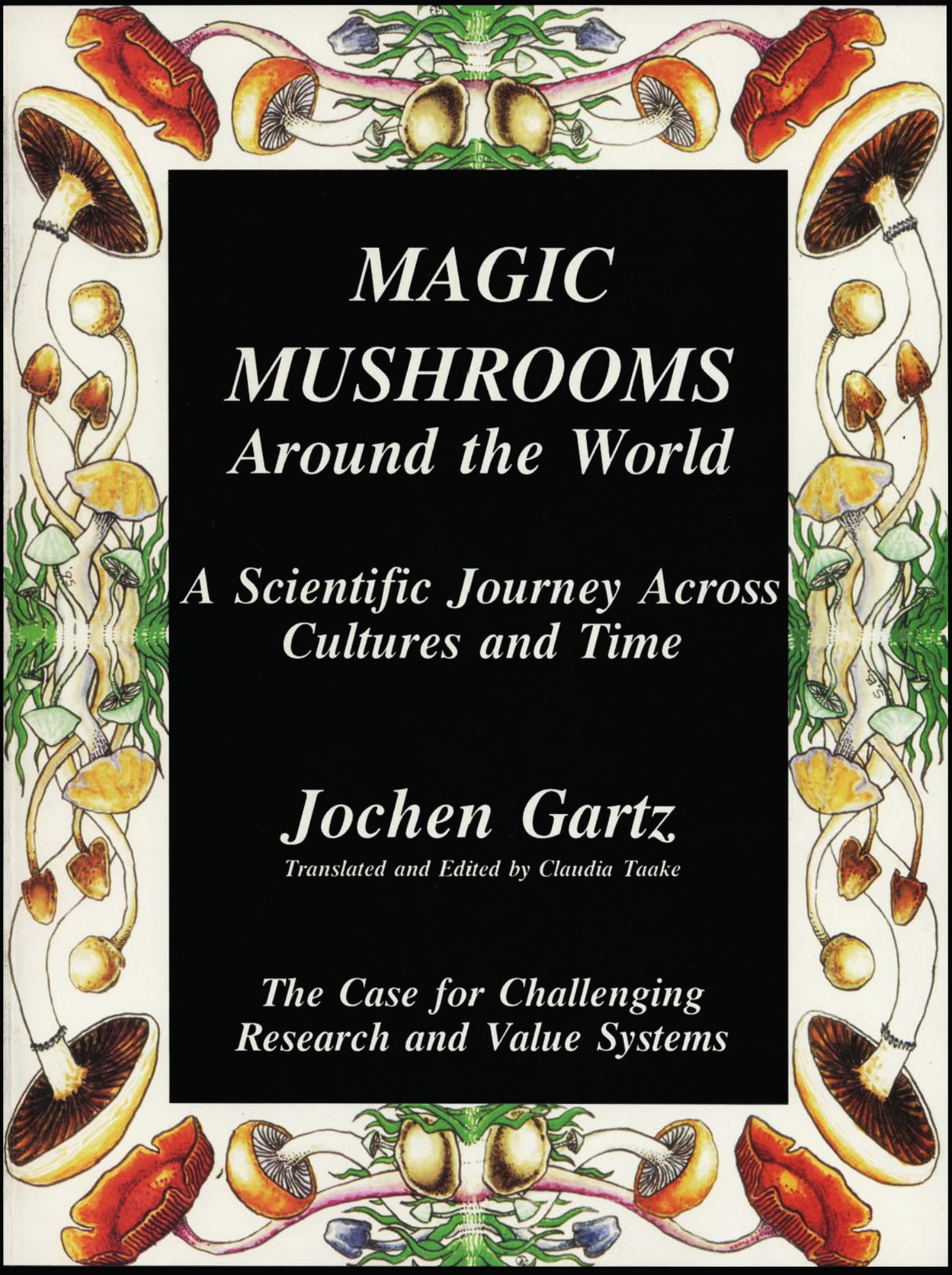


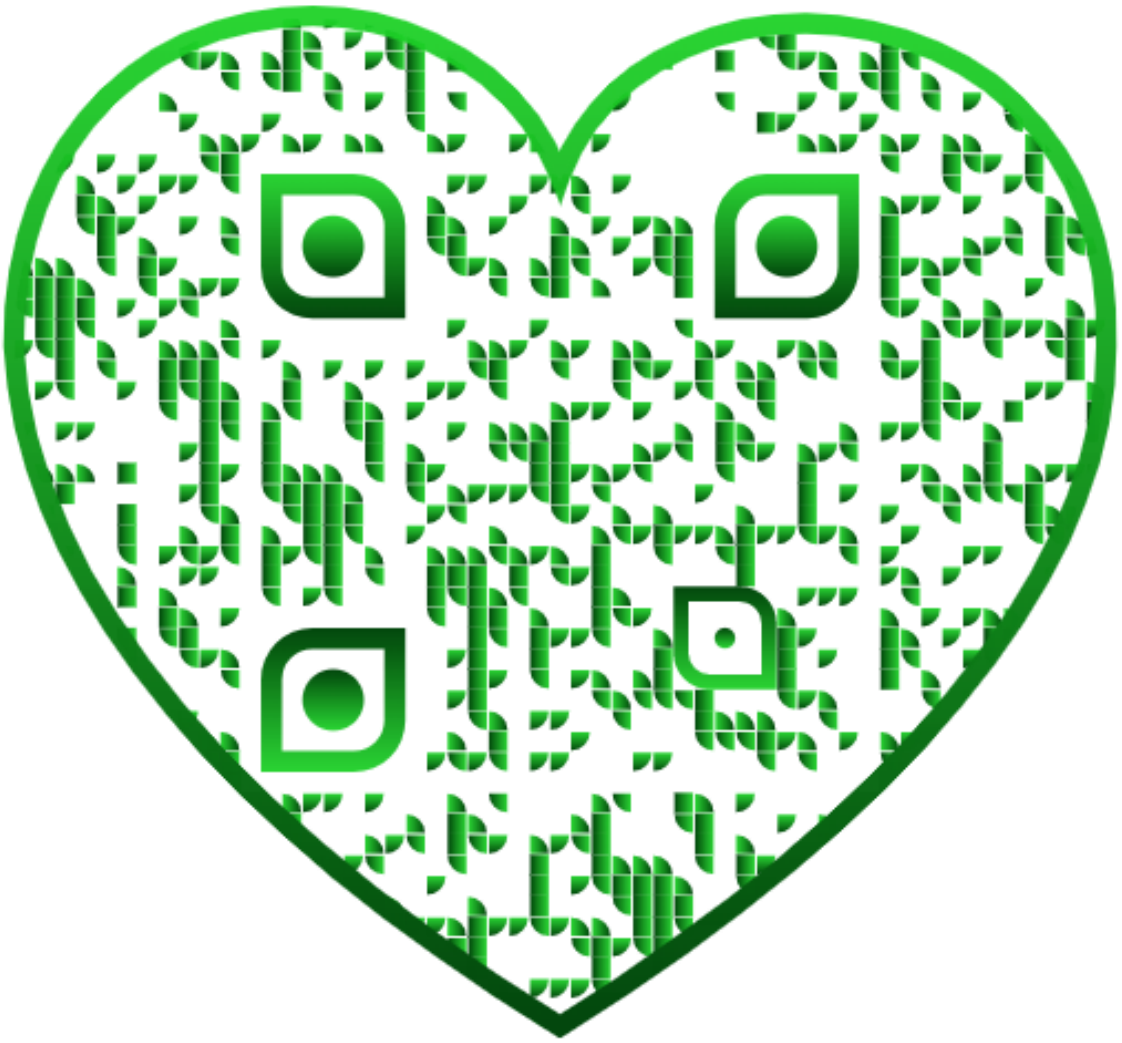
MAGIC MUSHROOMS Around the World

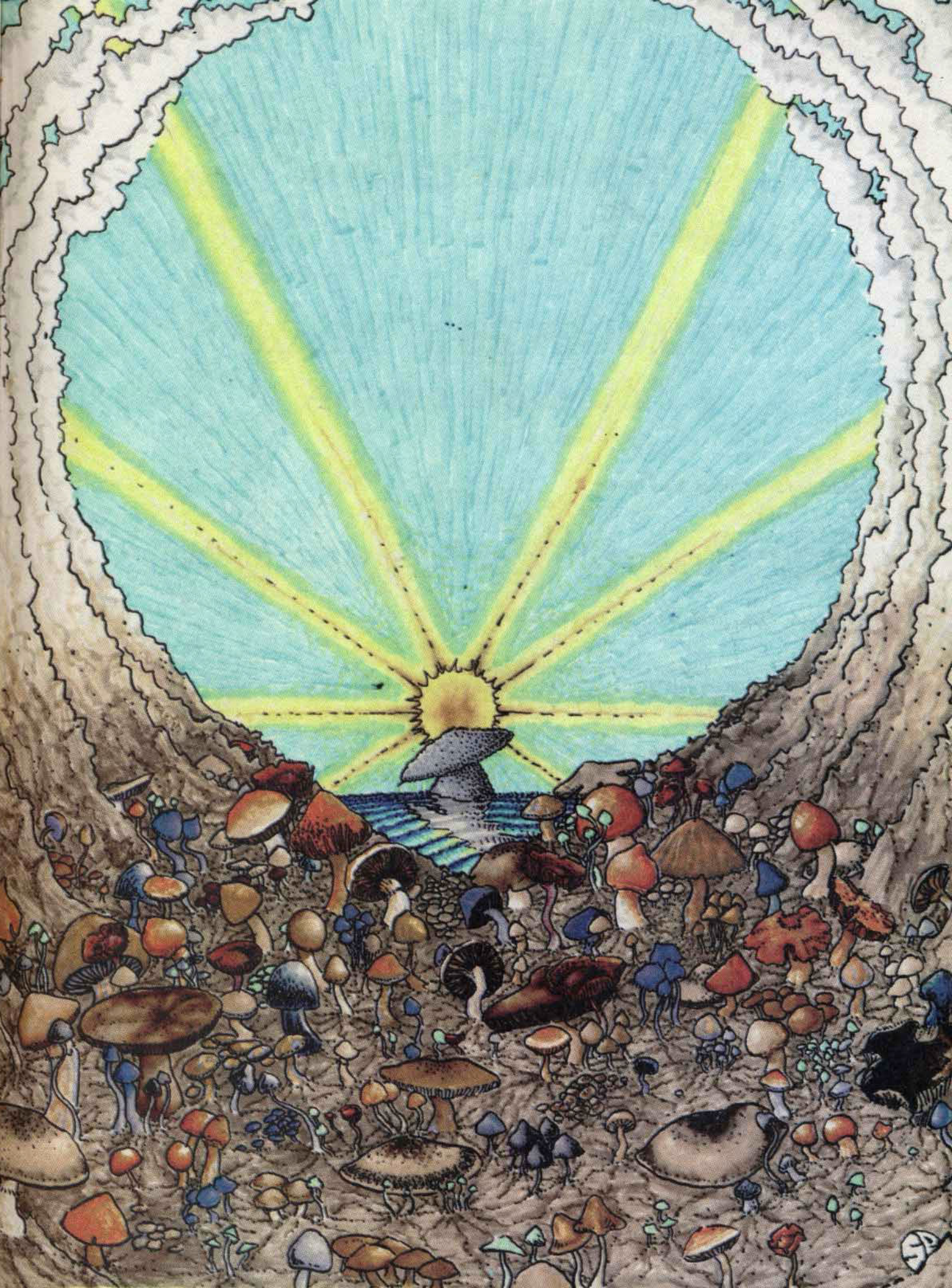
A Scientific Journey Across Cultures and Time

Jochen Gartz

Translated and Edited by Claudia Taake

The Case for Challenging Research and Value Systems





JOCHEN GARTZ

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Around the World

A Scientific Journey Across Cultures and Time

The Case for Challenging Research and Value Systems

*** LIS PUBLICATIONS * LOS ANGELES, CA***

Figure 1 - Water Color Painting of *Psilocybe semilanceata*
(Germany, 1927)

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Figure 2 - *Psilocybe cubensis* from Australia

Figure 3 - Water color painting *of* Panaeolus subbalteatus (Germany, 1927).

Figure 4 - Fresh Panaeolus subbalteatus mushrooms.

FOREWORD

WHO WAS THE FIRST MAGICIAN?

Nobody knows precisely when the first magic mushroom emerged from the shadows of prehistory to enter the light of consciousness. Nobody knows when the first magic mushroom was eaten by a human being. Nobody knows just who the first magic mushroom eater was. In seeking answers to these questions, we can only speculate. Mycophobes, however, are quick to voice their conviction that only a fool would be reckless enough to want to attain a higher state of consciousness beyond the boundaries of everyday reality. And only a fool would attempt to do this by ingesting those odd little things that mysteriously thrive on decaying, humid soil, rotten wood and malodorous mounds of cow manure.

Historically, magic, mushrooms have been feared and hated` since antiquity: magic mushrooms were thought to be made from poisons that had dripped from serpents' fangs; they were considered to be unclean emissions of evil spirits; moreover, mushrooms were a known cause of death and disease, bloated stomachs and insanity. Beliefs such as these have survived to the present day. They persist, for example,', as figures of speech, such as the slick Austrian description of a societal misfit as someone "who ate those madness-inducing mushrooms."

But, there is another, very different, magic mushroom legacy as well.

Flesh of the Gods for Devil Worshippers

The Old World. Mycenaean civilization began with a mushroom trip -Mushrooms were an ingredient in the ambrosia of Dionysus. Porphyrius, the fourth century Latin poet and contemporary of Emperor Konstantin, knew that magic mushrooms were the children of the gods. A quasi-cannibalistic ritual, the act of eating the children of the gods unlocked one's power to experience the truly divine. But not all mushrooms enable human beings to enter the realm of divine consciousness. This magic power resides in only those fungi known as "fool's mushrooms", which were considered poisonous and believed to be the spawn of the Devil throughout the late Middle Ages and well into modern times.

The New World: The Aztecs in Mexico referred to a number of small, inconspicuous mushrooms as teonartacatl, or "flesh of the Gods." These sacred mushrooms were eaten during the course of rituals intended to contact the Gods in order to learn about the world and the realm of the divine. These magic mushroom rituals thoroughly spooked the Catholic Spaniards. The mushroom eaters, commonly thought of as Devil worshippers, were hounded by the Inquisition. Still, all good things survive the tests of time, so the cult of magic mushroom eaters did not become extinct. Like mycelia underground, the cult continued to flourish, and at the proper time in recorded history, in 1957, the fruit of the fully grown mushroom re-surfaced to draw widespread public attention. Valentine and Gordon Wasson became the heroes of the modern neo-mycophilic movement.

Back to the Old World: The revelations and insights gained from the use of psychoactive mushrooms were so magically wonderful, that our native European "fool's mushrooms" - which were gene ; considered inedible - had to be recognized as closely related to the magic mushrooms of Mexico, the flesh of the Aztec Gods. The souls of magic mushrooms in Mexico and Germany are essentially made from the same substance: psilocybin.

Jochen Gartz has made an extraordinary contribution to the field of mycology by embracing Germany's magic mushrooms and the scientific study and testing of these fungi. The research efforts upon which this book is based require nothing less than a fearless, brave and courageous consciousness, free of prejudice and mycophobia. I am convinced that a researcher's consciousness infused by the spirit of the magic mushroom is capable of far deeper scientific insights than we can ever expect from the usual ivory tower academics, isolated from reality, and who gorge themselves on our tax dollars.

I met Jochen Gartz shortly after the fall of the Berlin Wall at the third symposium of the European College for the Study of Consciousness (ECSC) in Freiburg, Germany. Our encounter was my first contact with a researcher from the former East Germany. Jochen Gartz's enthusiastic lecture was a truly consciousnessexpanding event, his words breaking down traditional borders and crossing over into new territory. The magic mushrooms spoke through him - with no trace of dogma or ideology - in the tradition of true anarchy that is the hallmark of mushroom magic. What I heard was unbelievable. Jochen spoke of a "new" psychedelic mushroom and its migration. The mycelia had spread in concentric circles outward from Leipzig, jumping all political borders. Finally, when the mycelia reached West German soil, the hated Berlin Wall crumbled. Could there possibly be a connection between the evolution of the magic mushroom and the evolution of our consciousness? Could a mushroom have contributed to the resolution of our political conflicts?

In the past, politicians, even popes, had their own jesters and magicians, who functioned as pressure release valves in the machinations of political power struggles. It is obvious that a country whose chancellor is being pelted with eggs, urgently needs a new breed of magician who are able to readjust reality. But today, no aspiring magician should go about this task without this book as a guide for the wondrous journey into the realm of magic mushrooms.

Christian Rdtsch

Figure 5 - *"Anthropomorphic Beings Engaged in Mushroom Dance"*
10,000-year-old rock drawing in Tassili, Sahara (Algeria)

CHAPTER 1

I BELIEVE THE TIME HAS COME FOR A COMPREHENSIVE REVIEW OF NEW FINDINGS FROM THE FIELDS OF MYCOLOGY, TAXONOMY AND NATURAL PRODUCTS CHEMISTRY

When R.G. Wasson, R. Heim and A. Hofmann began their interdisciplinary research program to study the Mexican species of mushrooms and their usage in Mexican mushroom cults, their efforts culminated in a 1958 landmark report that described the isolation, molecular structure and synthesis of the mushrooms' active ingredients: psilocybin and psilocin. Several years later, these substances were also identified in a species of mushroom in Europe, *Psilocybe semilanceata,* which became the first in a series of newly discovered species. Since then, psychoactive mushrooms from other genera have been reported with increasing frequency.

As part of my analytical work dedicated to the identification of naturally occurring chemicals, I had the good fortune to be part of a research team that studied alkaloids found in a variety of mushroom species. Now I believe the time has come for a comprehensive review of new findings from the fields of mycology, taxonomy and natural products chemistry. Wasson and his successors have already provided detailed accounts pertaining to the history and study of the Mexican mushroom species, so that these materials need not be repeated in this context. However, certain aspects concerning the more recent uses of these mushrooms as well as their conditions of growth will receive more detailed attention in later chapters.

The main purpose of this book is to inspire further study of these mushrooms, particularly basic research efforts and medical applications of magic mushroom ingredients.

The extensive bibliography will help scientists and other interested mycophiles to further immerse themselves in this complex area of study.

Jochen Gartz

Figure 6 - Bronze doors with mushroom motif entitled "Trial and Judgment" at Hildesheim Cathedral, Germany (ca. 1020).

CHAPTER 2

REFLECTIONS ON THE HISTORY

AND SCIENTIFIC STUDY OF MAGIC MUSHROOMS

It is remarkable that cultures native to the American continent knew about a relatively large number of natural mind-altering substances compared to early cultures that evolved in Europe or Asia. Botanical evidence does not support the notion that Europe is home to fewer hallucinogenic plants than other regions. Furthermore, the growing number of recently discovered European mushroom species containing psilocybin indicate a flourishing psychotropic mycoflora in Europe similar to those found in other countries.

It is unlikely that early European cultures learned less about local plants and mushrooms through usage and experience than cultures elsewhere in the world. Most likely, early cultural knowledge of European psychoactive plants and mushrooms was lost or destroyed at some time in history, probably as early as several hundred years ago.

The discovery that the fly agaric mushroom (Amanita muscaria) was known for its psychoactive properties in Siberia invited the conclusion that this mushroom was used as a psychotropic agent in medieval Europe as well. In fact, there is very little evidence from the Middle Ages to indicate widespread knowledge of the effects of specific mushrooms on human consciousness. However, I believe that past reports on psychoactive mushrooms were causally linked to Amanita muscaria simply because this was the only known psychotropic mushroom in Europe at that time.

While the usage of Amanita muscaria among Siberian tribes has generated reports of spectacular hallucinations, European accounts of fly agaric intoxications do not generally include descriptions of such intensely hallucinatory effects.

Accordingly, the potent hallucinogenic effects of specific Psilocybes and related species are likely to have had a much more significant influence on early European cultures than the delirium-like visions induced by Amanita muscaria, a species that is also known to induce unconsciousness and severe somatic side effects. This hypothesis is corroborated by data from comprehensive field studies conducted in Mexico. I believe that historic accounts including those described below - indicate a knowledge of and familiarity with psychotropic mushrooms in Europe that is most likely derived from usage of Psilocybes and related species, rather than experience with Amanita muscaria. However, it is extremely difficult to reject or confirm this hypothesis, due to the lack of conclusive data available for analysis today.

Bwyd Ellylon: A Feast of Fairies in Celebration of the Spirit World

Tales of ritualistic mushroom usage have found their way into the realm of myths and legends. For instance, one legend describes a peculiar poisonous mushroom in Wales (British Isles) with the strange name of *Bwyd* Ellylon, which was considered a delicacy by fairies feasting in celebration of the spirit world. Psilocybe semilanceata is the most important psilocybin-containing mushroom in Europe and it thrives in parts of Great Britain, where the mushroom grows abundantly all across the Welsh countryside during fall season.

I would like to thank G. Samorini for pointing out that the Inquisition was unusually cruel and vicious in the Alpine valleys of Valcamonica, Valtrompia and Valtellina (located in the provinces of Brescia and Sandrio in Northern Italy). Many books chronicle countless witch burnings in that region, with particular emphasis on the witches' meetings at the "Monte del Tonale", located at an altitude of 2000 m (ca. 6,000 ft). Field research has shown that plants of the nightshade family ("witching herbs") do not grow at this altitude; even the fly agaric mushroom is rarely found there. By contrast, pastures in the area abound with Psilocybe semilanceata during the fall. Given this historical context, it would seem likely that Psilocybe

semilanceata played an important role as a psychotropic agent in the region (see Figure 58, Chapter 7.4).

In light of medieval accounts describing the practice of witchcraft, it is interesting to note that a subjective sensation of flying or levitation is among the commonly reported effects of psilocybin intoxication.

Berserk Rage of Nordic Warriors

In the course of the ideological power struggle between Christianity and the remnants of pagan religions that worshipped Nature, many sources of knowledge were lost. The aggressive repression and eradication of pre-Christian customs all but destroyed the continuity of Europe's original cultural heritage, along with much historic evidence documenting early cultural practices, including the usage of plants and mushrooms for the purpose of temporary alterations of consciousness.

Some authors went so far as to blame the fly agaric mushroom for proverbial fits of "berserk rage" attributed to Nordic warriors. Many accounts detailing this phenomenon allude to a "deception of the eyes" (i.e. visual hallucinations). After the Nordic legal system banished the practice of "going berserk", it disappeared quite suddenly during the 12th century. At about the same time, Saxo Grammaticus speculated that the Berserkers may have used magical potions.

It is just as plausible, however, to suggest that the hallucinogen of choice among early Nordic cultures was *Psilocybe semilanceata,* a mushroom species quite common in Norway. Neither *Amanita muscaria* nor *Psilocybe semilanceata* are generally known to cause states of intense rage. However, given the historic context, it is possible that, at the time, people had already begun to internalize negatively biased distortions and the demonization of psychoactive mushrooms and their effects, in order to justify the creation of new laws intended to destroy repulsive pagan customs such as the ritual use of mind-altering plants.

It is important to note the existence of ancient Northern European rock drawings that depict various mushroom themes, along with the discovery of bronze-age vessels decorated with mushroom-related artwork. The drawings often include renditions of zoomorphic entities as well as mushrooms. Significantly, they predate any reports and speculations about the Berserkers by over 2,000 years.

These ancient images suggest the evolution of early European mushroom cults - a cultural practice that most likely vanished during the early Iron Age, as did many other customs and social practices from that era. Still, the discovery of ancient Northern European mushroom cults is a powerful piece of evidence supporting the notion that psychoactive mushroom usage has been continuous throughout history.

In addition, a traditional Swedish custom has survived to the present day, revealing an early knowledge of a certain mushroom believed to evoke "visions of spirit entities". As part of summer solstice celebrations, a poisonous mushroom species ("Baran") was cast into the bonfires. Even though nothing is known about this fungus today, the ritual burning of a poisonous mushroom was intended to weaken the powers of goblins and other evil spirits. The mushrooms were viewed as symbolic incarnations of noxious spirits. The mushrooms' ritualistic destruction by fire thus destroyed the powers of evil and mischievous spirits. The assumption that some mushrooms are physical links to the intangible powers of the spirit world may have evolved from ancient fragments of knowledge about the psychoactivity of specific types of mushrooms.

There are a number of written reports about psychotropic mushrooms that date back to the late Middle Ages. While this collection of documents includes a variety of different sources from several countries, they provide remarkably similar descriptions of psychoactive mushrooms and the general nature of their effects.

Love Potions Brewed from *Bolond Gomba*

Clusius (1525-1609), for example, the great physician and botanist, discovered "bolond gomba" in Hungary. This mushroom was known under the German name "Narrenschwamm" ("fool's mushrooms"). It was used in rural areas, where it was processed into love potions by wise men or "javas asszony". At about the same

time, this "fool's mushroom" was documented in Slovakia as well. In addition, the mushroom found its way into the verses of Polish poet Vaclav Potocki (1625-1699), who refers to its potential of *"causing foolishness much like opium does ".*

Similarly, in England, John Parkinson's "Theatricum Botanicum" (1640) includes details about *a 'foolish mushroom ".*

The Austrian colloquial expression *"He ate those madness-inducing mushrooms"* refers to states of mental confusion.

Historic source materials such as these are scarce and widely scattered. Undoubtedly, they refer to psychotropic mushrooms, but lack sufficient information to permit clear identification of a specific species. However, considering the habitats and occurrence of *Psilocybe semilanceata* and *Psilocybe bohemica,* these two species are among the most likely candidates (see page 16 ff.). It is remarkable that these historic portrayals revolve around just one aspect of the mushrooms' overall effects: the occasional semi-schizophrenic reaction which can at times be quite dramatic. None of these accounts reflect a distinct appreciation of mushrooms in the tradition of the Mexican Indians ("teonanacatl" = flesh of the Gods).

Between Reverence and Fear

By contrast, in Europe we find that the symptoms of mushroom intoxication have always been compared to symptoms of mental illness. Such cross-cultural differences in value judgments can be explained in terms of two concepts introduced by R.G. Wasson and his wife: *mycophilia* and *mycophobia.* This distinction sub-divides cultures with different traditional attitudes towards mushrooms into two groups. For instance, an entrenched dislike for mushrooms (mycophobia) in Britain indicates traditional beliefs vastly different from those found in Slavic countries, where mushrooms are generally cherished (mycophilia). The origins and evolution of such diverging attitudes remain lost in the shadows of history.

The development of early cultural taboos and prohibitions against psychotropic mushrooms may be the root cause of enduring mycophobic behavior. On the other hand, it is possible that, thousands of years ago, the process of harvesting mushrooms as a food source caused alarming clusters of regionally isolated cases of fatal mushroom poisonings. Such experiences may well have seeded a potent and lasting aversion towards an entire country's mycoflora.

Similarly, the mycophilia typical of ancient Mexican cultures goes hand in hand with a general social acceptance of the effects of *Psilocybe* mushrooms and their established ritual usages. Among Mexican Indian tribes, the effects of psilocybin have never been causally linked to any type of known mental illness. It is interesting to note that the Indians of Mexico were the only Indians in the Americas who also harvested a large number of mushroom species for food.

Unfortunately, our current socio-political climate is - strongly biased against newly discovered hallucinogens, which are often defined in terms of negatively loaded labels. Even worse, such prejudicial thinking distorts an objective, scientifically neutral approach to the study of these substances. The label "fool's mushroom" first appeared during the 1930s, along with "Mexican mushroom of insanity". In the 1950s, the Central American mushroom cults were discovered and the mushrooms themselves were renamed "Mexican magic mushrooms", in recognition of their psychotropic effects and to emphasize the significance of the mushrooms' early integration into the social fabric of the cultures that cherished them.

Later on, the relatively neutral label "hallucinogenic mushroom" came into use in the mycological literature. Other designations that gained and lost popularity over time include the somewhat derogatory term "intoxicating mushrooms" and the essentially meaningless "drug mushrooms".

Scientifically Unbiased Hallucinations?

Following his experiments with magic mushrooms in Mexico during the summer of 1960, T. Leary returned to Harvard University and began to study psilocybin as a variable in the administration of standard psychological test batteries. His initial focus was diluted when he continued to expand his experiments to include increasingly broader settings and applications. In

reaction to Leary's markedly unorthodox approach, the American press began to portray psilocybin mushrooms in terms of slanderous terminology that far exceeded the negative connotations of labels such as "fool's mushrooms". Descriptions of the mushrooms' effects included claims that users experienced "death-like states".

Proponents of psilocybin research were accused of denying that the alkaloid caused "semi-permanent brain damage". This pseudo-scientific jumble of meaningless jargon was symptomatic of the sharply escalating controversy surrounding hallucinogenic substances. Increasingly, news reports on psilocybin were eclipsed by massive amounts of publicity about LSD - the most potent hallucinogen ever discovered. The subsequent frenzy of legislative attempts to control LSD resulted in ever tighter restrictions on the scientific study of not only LSD, but psilocybin as well. Mind-altering substances were no longer thought of in terms of their specific effects and properties, but rather were lumped together into a single group of dangerous chemicals. As antidrug hysteria continued to intensify, scientific and pharmacological distinctions became all but irrelevant: hallucinogens were no longer viewed as different from other classes of dangerous and physically addictive drugs, such as heroin or the opiates. This demonization of hallucinogens was successful in spite of massive research efforts that began when Sandoz Pharmaceuticals decided to distribute psilocybin to qualified scientists for experimental and psychotherapeutic purposes. By employing the method for synthesis of psilocybin developed by A. Hofmann, Sandoz Pharmaceuticals manufactured about 2 kg (ca. 4.4lbs) of pure psilocybin for scientific research purposes.

The results of pharmacological testing soon revealed psilocybin as an alkaloid that was perfectly safe for human subjects under controlled experimental conditions. Despite this evidence, the anti-drug legislative framework of the mid1960s firmly established an "official mycophobia", a misguided, yet entrenched policy that still prevails today and effectively prevents the scientific investigation of promising potential applications for psilocybin and other alkaloids. At the same time, mycological and biochemical research studies have shown that psilocybin-containing mushrooms thrive all over the world and can be found on all continents. These mushrooms are no different from any other mycoflora and must not be excluded from scientific investigation because of their alkaloid content.

In addition to overall variations in value systems across cultures, individuals tend to develop their own personal attitudes towards mushrooms in general. Oftentimes, the evolution of specific opinions about mushrooms can be traced back to childhood events, even though such early experiences seldom account for the development of prevailing biases and value systems later in life.

I recall an incident from my own childhood, which occurred when I was about five years old. I was playing in a grassy meadow, when a girl pointed to a brown mushroom and earnestly explained that it was inedible and poisonous. While I have never forgotten this encounter, I did grow up to become a devoted mushroom enthusiast. On the other hand, a different childhood event has left me with the vivid memory of discovering a landfill virtually covered with vast numbers of gilled bluing mushrooms and the sense of awe I experienced contemplating this sight. In general, the unusual characteristics of these mushrooms are most likely responsible for strong impressions formed early in life, which then may develop into various attitudes or beliefs later on.

An enduring personal interest in psychotropic mushroom species can serve to amplify or diminish mycophobic as well as mycophilic dispositions, depending on the influence of other factors. After all, judgments about the benefit or folly of deliberately altering one's state of consciousness are also colored by individual preferences, biases and opinions.

The following chapters are meant to illustrate this diversity of attitudes towards psychotropic mushrooms. Descriptions of planned and involuntary experiments with specific mushroom species offer convincing evidence that the effects of psychoactive mushrooms are open to many possible interpretations.

CHAPTER 3

THE CURRENT STATE OF KNOWLEDGE ABOUT EUROPEAN SPECIES

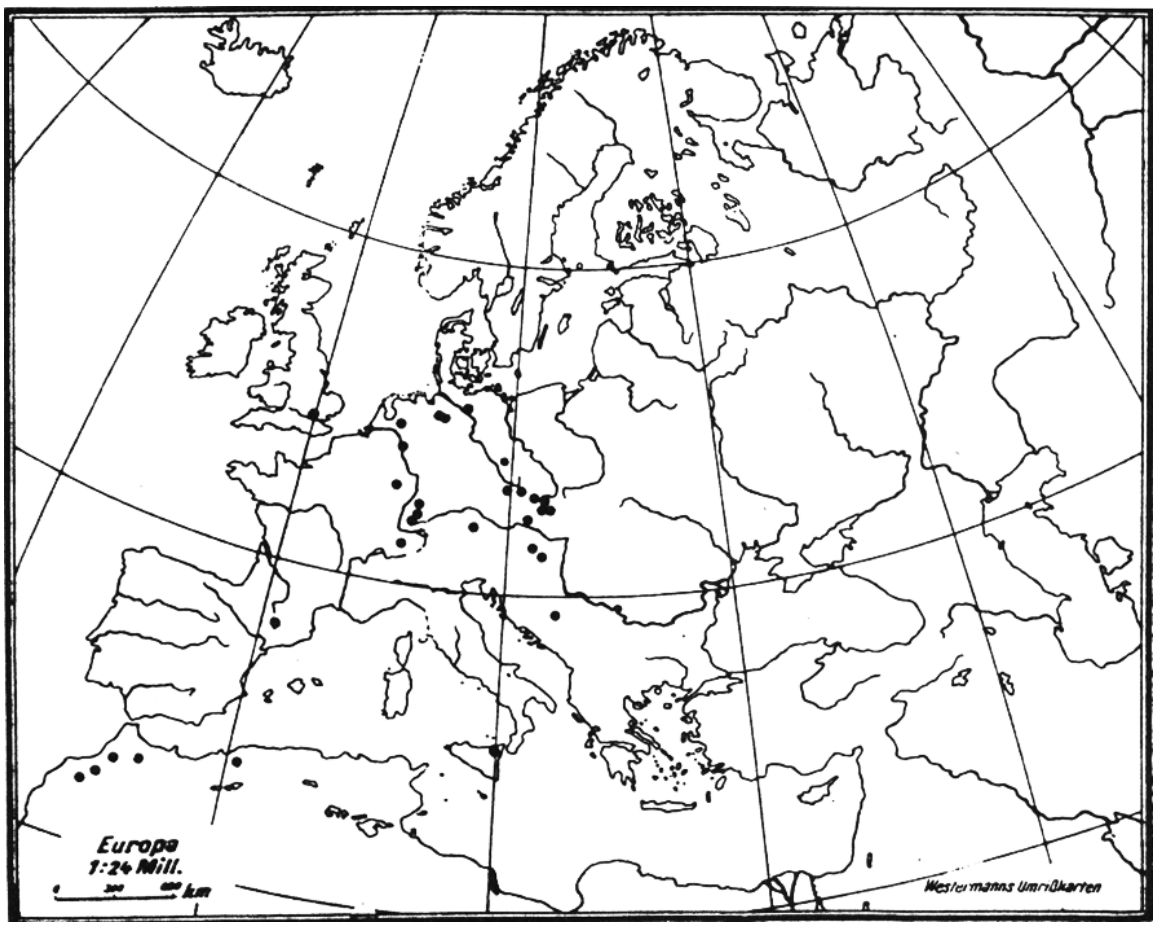


Figure 7 - Distribution pattern of ***Psilocybe cyanescens*** across Europe and North Africa (according to Krieglsteiner). Black dots indicate approximate locations where ***Psilocybe cyanescens*** was found.

Mr. E Branl, on a poisonous Species of Agaric

To the Editors of *the Medical and Physical Journal.*

Gentlemen,

IF the following account of the deleterious effects of a very common species of agaric, not hitherto generally suspected to be *poisonous,* appears to you likely to prove *useful* or interesting to the public, you will oblige me by its insertion; should its length be any obstacle to this, I beg you will omit whatever you may think superfluous. I remain,

Gentlemen,

No. 10, Arlington -*Street,* Yours, most obediently,

Nov. *16th, 1799.* EVERARD BRANDE.

J. S. gathered early in the morning of. the third of October, in the Green Park, what he Supposed to be small mushrooms; there he stewed with the common additions in a tinned iron saucepan.* The whole did not exceed a tea saucerful, which he and four of his children ate the first thing, about eight o'clock in the morning, as they frequently had done without any bad consequence; they afterwards took their usual breakfast of tea, &c. which was finished about nine, when Edward, one of the children, (eight years old,) who had eaten a large proportion of the mushrooms, as they thought them, was attacked with fits of immoderate laughter, nor could the threats of his father-or mother restrain him. To this succeeded vertigo, and a great 'degree of stupor, from which he was roused by being called or shaken, but immediately relapsed. The pupils of his eyes were, at times, dilated to nearly the circumference of the cornea, *and* scarcely contracted at the approach of a strong light ; his breathing was quick, his pulse very variable, at times imperceptible, at others too frequent and small to be counted; latterly, very languid; his feet were cold, livid, and contracted, he sometimes pressed his hands on different parts of his abdomen, as if in pain, but when roused and interrogated as to it, he answered indifferently. yes, or no, as he did to every other question, evidently without any relation to what was asked. About the same time the father, aged forty, was attacked with vertigo, and complained that every thing appeared black, then wholly

* This accuracy may seem trivial, but I have met with people who supported the following symptoms might have arisen from the use of a copper vessel.

Figure 8 - Reproduction of a report from the mycological literature (1799) describing a case of ***Psilocybe semilanceata*** intoxication.

CHAPTER 3.1

PSILOCYBE SEMILANCEATA: THE CLASSIC SPECIES AMONG EUROPEAN PSYCHOTROPIC MUSHROOMS

Listen Well to this Frightful Story from St. James's Green Park....

About 200 years ago, E. Brande published an account about a remarkable case of mushroom intoxication in London. On October 3, 1799 an impoverished family picked some mushrooms in St. James's Green Park and prepared them for a meal (see Figure 8, p. 15).

Shortly after eating the mushrooms, the father and his four children developed symptoms of intoxication, such as markedly dilated pupils, spontaneous laughter and delirium. The progression of symptoms was experienced as wave-like, with cycles of increasing and fading intensity. In addition, the father's visual perception was affected so that everything around him appeared to be black - a frightening experience he believed to presage his impending death.

Even though two family members (ages 12 and 18) consumed only small amounts of the cooked mushrooms, the ensuing symptoms of intoxication were no different from those observed in family members who had eaten comparatively larger portions. After several hours, the psychic and perceptual disturbances subsided and finally disappeared, without any lingering side effects. Attempts to treat acute symptoms included administration of emetics and fortifying tonics. In the end, these potions were heralded as the crucial treatment that "cured" the family.

For the most part it is extremely difficult, if not impossible, to assemble complete and accurate details on many aspects of magic mushroom history from source materials available today. Thus, it is an instance of rare good fortune and a boon to mushroom historians that E. Brande's description of a typical psilocybin syndrome was augmented by J. Sowerby, author of "Coloured Figures of English Fungi or Mushrooms" (London, 1803). Sowerby's book included a rendition and description of the mushroom species responsible for the poisoning case described by Brande (see p. 17). Within the context of Sowerby's book, only the variety of mushrooms distinguished by their cone-shaped caps were believed to cause intoxication. Figure 9 shows a typical rendition of Psilocybe semilanceata. This mushroom species was known to Sowerby's contemporaries as "Agaricus glutinosus Curtis" and its descriptions are fully compatible with current knowledge about Psilocybe semilanceata.

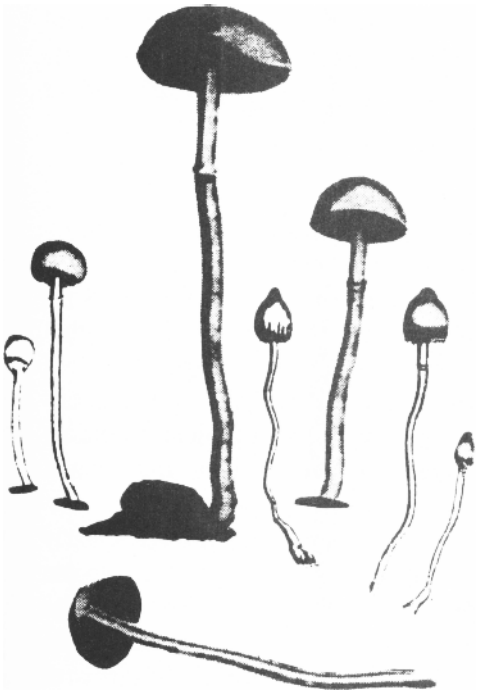
A few years later, renowned Swedish mycologist E. Fries referred to "Agaricus semilanceatus" in his book entitled "Observationes Mycologicae" (1818). Later on, the same mushroom also appeared under the names Coprinarius semilanceatus *Fr.* or Panaeolus semilanceatus (Fr.) Lge. Not until 1870 did Kummer and Quelet classify this mushroom as a member of the genus Psilocybe. Consequently, two valid designations may be found in the literature:

-- Psilocybe semilanceata (Fr.) Kumm. or --
-- Psilocybe semilanceata (Fr.) Quel.

Around 1900, M. C. Cooke reported two or three new instances of accidental mushroom intoxication involving children in England. Interestingly, Cooke noted that symptoms were caused only by a variety of mushroom known to turn blue (var. caerulescens). He was the first mycologist to wonder if a bluing variety of this species was poisonous, or if the bluish color was induced by external factors, causing changes in the mushroom's chemical composition so as to render them poisonous.

Early Descriptions

A close relative of Mexico's psychoactive species, Psilocybe semilanceata is a mushroom whose physical appearance resembles Psilocybe semperviva Heim & Cailleux and Psilocybe



Stalks generally single, sometimes clustered, from two to four inches in height, the thickness of a goose quill, thread shaped whitish almost solid, the tube being very small, glutinous; ring, a little below the cap, scarce perceptible.

" Cap, from one to two inches in breadth, of a brown color; in the full. grown ones hemispherical, always convex, and more or lets glutinous; wet with rain, it becomes browner and transparent,'so that it sometimes appears striated.

" Gills numerous, single, of a brownish purple color, clouded; whole ones about twenty, horizontal, three shorter ones placed betwixt them; they throw out a powder of a brownish purple color."

With respect to the use of it, he only says, « There is nothing acrimonious or disagreeable in its taste, yet its appearance will not recommend it to the lovers of mushrooms."

Figure 9- Drawing and description of ***Psilocybe semilanceata*** by J. Sowerby (London, 1803).

1733. A. semilanceatus Fries (Observ. II. **pag. 178).**

Synon. : Agaricus semiglobatus Sowerby (Engl. Fungi taf. 240. fig. 1-3). Hut etwas hautig, spitz kegelfdrmig, fast zugespitzt, 1 1/2 Cent. breit, 1/2 Cent. hock, feucht klebrig, fein streifig, gelb oder grunlich, zah, mit Anfangs umgeknicktem Rande und leicht trennbarer Oberhaut. Stiel zah, gebogen, 11 Cent. hock, kahl, blass. Lamellen angeheftet, aufsteigend, purpur-schwarz. Sporen ellptisch, hellbraun, 9 -16 u lang, 4 - 9 u dick.

Ax **Wegen, auf Grasphitzen, besonders wo Mist gelegen hat.**

spitzkegeliger Kahlkopf (Psilocybe semilanceata). Kegel-glockenformig mit papilenertiger spitze Hut-o,5-1 cm breit, bis 2cm hock, lehmfarben mit oliv-grunem Stich, klebrig. Lamellen breit, oliv-lehmfarben, spater purpurbraun. Stiel schlank, glanzend. - Gedungte Wiesen, Wegrander. Stellenweise. Wertlos.

Figure 10 - Two descriptions of ***Psilocybe semilanceata*** from the German-language literature. The first description (top) was written over a hundred years ago, while the second one (bottom) dates to 1962. Significantly, the more recent entry classifies the species as "essentially worthless". Also see Figure 11.

mexicana Heim. Like *Psilocybe semilanceata,* these Mexican species thrive in meadows and pastures. Another common trait among these species is the rather subdued and subtle quality of their bluing reaction. Recognition of these similarities with Mexican species sparked the curiosity of scientists who wanted to learn more about Europe's *Psilocybe* species. A research team that included A. Hofmann and R. Heim began to study samples of *Psilocybe semilanceata,* in collaboration with C. Furrer, a mycologist who examined fruiting bodies collected in Switzerland and France. By 1963, paper chromatography testing had yielded data of historic significance. For the first time, scientists had confirmed the presence of 0.25 % psilocybin in dried samples of *Psilocybe semilanceata.* Publication of the results represented an extraordinary achievement, because psilocybin had never before been detected in a European mushroom species. Previously, the alkaloid had been found only in *Psilocybe* species native to Mexico, Asia and North America.

While *Psilocybe semilanceata* was not recognized as an important psychoactive species until the 1960s, descriptions of the species were included in many standard German language mycology reference books published before 1963. Figure 10 shows examples of two such descriptions, one of them dated 1962 and the second one written about 60 years earlier. Note that the 1962 version designates *Psilocybe semilanceata* as a "worthless" species - a rather incongruous conclusion likely to amuse today's readers. On the other hand, accounts of and knowledge about cases of mushroom intoxication in England did not find their way into Germany's mycological literature. A few authors, such as Michael & Schulz (1927) and A. Ricken (1915) see Figures 11 and 12, pp. 19-20) contributed excellent and valuable descriptions of *Psilocybe semilanceata,* but these are the exceptions, rather than the rule. A description of *Psilocybe semilanceata* from 1977 reflects less emphasis on details, and a rather cursory approach to differentiation of the species, except for additional data on the mushroom's microscopic characteristics (see Figure 13).

In addition, a German aquarelle painting from 1927 of five fruiting bodies depicts the mushroom's habitus in remarkably realistic detail (see Figure 1, p. 4).

In 1967 and 1969 *Psilocybe semilanceata* samples from Scotland and England were found to contain psilocybin as well. Later on (1977), Michaelis reported discovering the alkaloid in samples collected in Germany (see Figure 14).

The Popularity of *Psilocybe semilanceata*

Since the late 1970s, investigators in several countries have been using of state-of-the-art methodology (High Performance Liquid Chromatography) to test samples and quantify their alkaloid content. The following sections include more detailed reviews of these tests and their results.

Psilocybe semilanceata has clearly established itself as *t h e* psychotropic mushroom species in Europe. The species thrives throughout the European continent, where it has sparked extensive research efforts. In terms of usage, *Psilocybe semilanceata is* Europe's most popular psychoactive species. In his 1983 monograph, Guzman suggests that *Psilocybe semilanceata* may well be the most common psychoactive *Psilocybe* mushroom in the world. Even though the species is known to flourish in Europe, North America, Australia and Asia, the mycofloras of many countries have not yet been studied or documented. Thus, we cannot yet evaluate the prevalence of *Psilocybe semilanceata* on a global scale.

In Europe, however, discoveries of *Psilocybe semilanceata* have been reported from the following countries: Finland, Norway, Sweden, Denmark, Germany, Switzerland, Austria, The Netherlands, Belgium, France, Russia, Poland, the former Czechoslovakia, Hungary, Romania, Scotland, England, Wales, Italy and Spain.

Unfortunately, there are no comprehensive maps detailing the species's distribution pattern. Traditionally, mycologists have often neglected relatively tiny species, such as *Psilocybe semilanceata,* that tend to share their habitats with other, more prominent species. The sarcastic phrase *"The mushrooms occur in abundance wherever mycologists abound" is* particularly pertinent in reference to the *Psilocybe* species. Prior to the discovery of psilocybin, the *Psilocybe* genus languished in the literature, shrouded in obscurity. To this day, few

189. Psilocybe semilanceata Fr. [Worthless]

The cap is uniformly conic to bell-shaped, with a pointy or obtuse center forming an almost wart-like protrusion; initially, caps are often taller than they are wide, margins are bent and curved inward; later on, width of cap is 1.5-4 cm. Hygrophanous; coloration is a dirtyish olive-brown when wet, with translucent striate margins; at the center, coloration is ocher or greenish-yellow against an overall shade of smudgy pale yellow and oftentimes some greenish stains; only the margins are banded by a darkcolored, watery stripe around the edge. No stripes or banding evident when mushrooms are completely dried. Lacking a veil, caps are thin-fleshed, bald, with an easily separable pellicle that remains gelatinous-sticky for a long time, turning shiny when dry.

Gills are olive brown to blackish purple brown in color, with the edges often remaining white, gill spacing is quite crowded; gill attachment is either roughly linear or mostly adnexed; up to 3.5 mm wide; attached at the stem only, fully detached later on.

Spores are elongated to ellipitical in shape, smooth and large, measuring 12-16 u by 6-8,u. Color of spore dust is blackish purple brown.

Stem is very slender, almost uniformly thin and always twisted, 6-12 cm long and 1.25-2 mm thick, yellowish or whitish in color; areas subjected to pressure develop bluish-green stains. Stems are silky smooth and roughly at the center, cortinate fibrils appear like remnants of a veil, which is brittle and lined with a white fibrous cord of wool-like texture.

When dry, the flesh of the cap is colored pale yellow, while the stem's flesh is ocher brown in color, especially towards the bottom. It is odorless and its flavor is mild. The mushroom grows from August to October, frequently in gregarious clusters, and can be found in pastures and along roadways, growing on dung that has undergone complete decomposition. It is not a particularly rare species.

Figure 11*(above)* This excellent description of ***Psilocybe semilanceata*** by Michael & Schulz (1927) is shown here as originally published in German, with an English translation.

757. Psil. semilanceáta (Fr. 1818). **Spitzkegeliger Kahlkopf.** Taf. 66, Fig. 6.

H. braunoliv oder *grünlichgelb*, zartgerieft, mit schmieriger, leicht abziehbarer Haut, kahl und nackt, auch ohne Spur eines Velums, *bleibend-spitzkegelig, höher als breit* 1,5/1,5—2, mit anfangs eingekricktem Rande, fast häutig. **St.** bräunlichblaß, fast seidenglänzend, faserig, fast gleichdünn 7—10/2, bisweilen aufwärts fast verdickt, wellig-verbogen, knorpelig, markig-ausgefüllt oder innen weißwollig. **L.** olivbräunlich, schl. *rotbraun* mit weißer, gefranster Schneide, aufsteigend, angeheftet. **Fl.** feucht gleichfarbig, trocken blaß, mild, geruchlos.

Auf Triften, an Graswegen, gesellig 9—10. Nicht selten. Sp. länglich-elliptisch 12—16/6—8 *µ*, glatt, 25—30/8—10 *µ*, Cyst. an Schneide spindelig-pfriemlich 20—25/4—5 *µ*. Eine durch den bleibend-schmalkegeligen, grünlichen, schmierigen Hut auffallende und sehr bestimmte Art, stets mit aufsteigenden, fast linearen Lamellen.

Figure 12 - A. Ricken's description of *Psilocybe semilanceata* from 1915.

Beschreibung: *Psilocybe semilanceata* (Fr.) Quél. (= *Geophila semilanceata* Quél.)

Hut gelbgrünlich bis braunoliv, oft blaugrün-fleckig, mit zartgeriefter, schmieriger, leicht abziehbarer Oberhaut; kahl ohne Velum, spitzkeglig mit mehr oder weniger scharf ausgeprägter spitzer Papille, höher als breit, sehr dünnfleischig, 2 cm breit und 2,5 cm hoch (1,5/1,7 cm oder 1,2/1,5 cm) mit anfangs eingebogenem Rand. Stiel 8–10 cm manchmal bis 15 cm lang, schlank, 2–3 mm dick, hellockerfarbig bis blaßbräunlich, Stielbasis häufig blaugrün gefärbt, faserig, etwas seidig-glänzend, bisweilen aufwärts verdickt, knorpelig-weißmarkig-wattig gefüllt; immer wellig-verbogen. Lamellen oliv-braun bis dunkelrotbraun mit weißer, flaumiger Schneide, gedrängt, aufsteigend, schmal, leicht bauchig-lanzettlich; bei kleinen Stücken fast linear angeheftet. Fleisch im Hut blaß-gelblich, im Stiel bräunlich werdend, ohne auffälligen Geruch oder Geschmack. Sporen länglich-elliptisch, erst grauviolett dann gelbbraun durchscheinend, glatt, mit Keimporus, 11–15 x 6,4–8 µm; Sporenstaub purpurbraun. Zystiden an der Blattschneide zahlreich, spindelig-pfriemlich, 22–27 x 6–8 µm. Basidien 4sporig, 25–35 x 8–10 µm.

Figure 13 - Description of *Psilocybe semilanceata* by H. Michaelis (1977).

Psilocybe semilanceata (Fr.) Quel. (Spitzkegliger Kahlkopf)
Nachweis von Psilocybin in deutschen Funden

Von H. Michaelis

Im Oktober 1972 fand ich in Thüringen *Psilocybe semilanceata* (Fr.) Quél., die nach Heim (1969) die einzige Psilocybin enthaltende Psilocybeart in Europa und nach Ricken ein häufig vorkommender Pilz ist. Da die Untersuchung von Pilz-Inhaltsstoffen zunehmend an Bedeutung gewinnt und in USA, Kanada, England, Frankreich und der Tschechoslowakei in dort wachsenden *P. semilanceata* Psilocybin nachgewiesen wurde, sollte mit diesem Beitrag festgestellt werden, ob dies auch für in Deutschland (Bundesrepublik und DDR) wachsende Pilze dieser Art zutrifft.

Figure 14 - Excerpt from the first article reporting the discovery of psilocybin in *Psilocybe semilanceata* samples from Germany (Michaelis, 1977).

Mycologists specialize in the study of *Psilocybes,* despite the fact that *Psilocybe semilanceata is* the most common and conspicuous species among the *Psilocybes. Also,* mushroom lovers whose interests are not purely scientific (see Chapter 7.4) do not usually preserve their knowledge for posterity in the form of distribution maps.
However, there is one map from 1986, which shows the distribution pattern of *Psilocybe semilanceata* across Germany (see Figure 20, p. *28).*
Almost no published information is available about locations where *Psilocybe* species have been found in eastern Germany. During my own field trips, I have discovered *Psilocybe semilanceata* specimens in various locations, such as near my hometown of Mansfeld in the Vorharz Mountains, in the marshlands of Duben as well as in other eastern German marshland areas. In addition, friends who are also mycologists have told me about finding the mushrooms in other parts of the country. A book published in 1952 is among the rare sources that includes details about specimens discovered in the southeastern state of Saxony (see Figure 16, p. 23).

The *Psilocybe* species grow most abundantly on wet pastures surrounded by forest areas. In my experience, *Psilocybe semilanceata* grows in most of Germany's forestlands. The species fruits during the fall, from late September through October. It favors acidic soil and grassy terrain alongside trails or around the edges of forest lands. Specimens are generally clustered in small groups of 30 mushrooms or less. Deer droppings or other animal feces are usually present at those locations, even though the mushrooms never grow directly on top of dung. Occasionally, extremely stunted specimens may be found in the mountains by the side of the road.

The soil below older cow pastures provides an excellent medium for extensive mycelial growth. In some locations, large areas yield an abundance of fruiting bodies, mirroring the extent of mycelial saturation in the soil. Given adequate moisture, maximum yields can be expected, if the pasture was grazed at least once during the weeks before fruiting season. However, the mushrooms also thrive under similar conditions on horse and sheep pastures. Such grassy areas inside forests are usually grazing areas for deer, who provide the soil with additional fertilization. *However, Psilocybe semilanceata does not grow in locations where artificial fertilizer has been used.* Such pastures are often flanked by creeks or swamp lands, which saturate the soil with water. During the summertime, the warm climate in these wet areas provides an excellent environment for optimal mycelial growth. In Germany, the mushroom's habitat ranges from the coastal areas to mountainous regions, where the species has been found at altitudes of up to 1,720 m (5,160 ft) above sea level (MTB-8443, 1985). In the former Czechoslovakia, samples have been collected at altitudes ranging from 330 to 1,000 m (1,000 - 3,000 ft), with one location at 1,400 m (4,200 ft) above sea level. According to these distribution patterns, the species does not appear to favor a specific altitude. As of 1986, 44 locations in the former Czechoslovakia had been logged, yielding a total of 54 samples. In contrast to other mushroom species, such as the cultivated commercial white mushrooms *(Agaricus bisporis), Psilocybe semilanceata will* fruit in a comparatively much wider range of temperatures.

While *Psilocybe semilanceata is* common throughout Germany, the species does not appear to favor specific areas where it occurs in marked abundance or density. One obvious limitation on the growth of the species is the limited presence of fertilizer in areas that would otherwise be excellent locations for the mushroom to thrive in. Most likely that is why the species has not expanded into new habitats in Germany over the last few decades. Descriptions of frequency of occurrence in the older literature are comparable to contemporary observations.

On occasion, however, *Psilocybe semilanceata* can produce a huge number of fruiting bodies at certain locations where conditions for growth are excellent.

Between a Creek and a Marshlands Pond....

8'½ Inches Tall !

At this point, I would like to provide some more details about two marshlands locations, where we have conducted mycological field research over the course of several years.

At the first location, the fruiting bodies grew in a shallow grass valley among very tall grass on slightly acidic soil. This grassy area was

a forest clearing between a creek and a marshlands pond. In areas exposed to direct sunlight, temperatures were significantly higher than they were in surrounding areas, a phenomenon that persisted during the fall season. Deer droppings contributed to frequent fertilization of the area. The fruiting bodies from the first batch of mushrooms found in this location had stems of up to $8^{1}/_{2}$ in.[!] (21.5 cm) tall, due to very tall grass in the area. The caps of the mushrooms were so tiny, that clear identification of the species as *Psilocybe semilanceata* was not immediately possible. Even though a bluing reaction was present, chromatography testing was needed to confirm the species. Subsequent discoveries, however, yielded samples that could be identified on the spot based on their morphological characteristics. We were able to collect 30 to 60 specimens at this location every fall for three consecutive years. Unfortunately, the location was destroyed soon afterwards, due to man-made modifications to the marshlands and construction of an access road.

During the same year, we discovered a second location within about half a mile of the first one. The area was very large, a former cow pasture which had been grazed regularly. It was located next to a creek that saturated the soil completely. Today, sheep occasionally graze the area and deer droppings are commonly found in the grass. Here, *Psilocybe semilanceata* fruits in abundance. Each fall season, the pasture is covered with hundreds of fruiting bodies (see Figure 15, p. 23).

For three years, we returned to the area three times each fall, and harvested a total of 2,800 mushrooms (ca. 140 g or 5 oz dry weight) at the location. While some of the fruiting bodies could be spotted easily on the grassy soil (see Figure 17) the vast majority of the specimens were usually concealed inside clumps of grass (see Figure 18).

When the weather is dry, *Psilocybe semilanceata is* an easily recognizable species. The fruiting bodies are extremely hygrophanous, which is why the color of the caps changes to a dark olive black-brown when the mushrooms are wet. Only a close inspection of the gills and the crooked stems enabled us to differentiate the wet mushrooms from the *Panaeolus* species (see Chapter 3.3). Like many other psychotropic mushroom species, a crucial characteristic of *Psilocybe semilanceata is* the blue discoloration of parts of the cap and the lower half of the stem, While the degree of discoloration is relatively minor, it is particularly noticeable when the mushrooms are wet. Fruiting bodies that are old and wet may spontaneously develop transparent, blue stains across their caps. On the other hand, discoloration of the stems does not set in until the fruiting bodies have been separated from the mycelia for about 30 to 60 minutes. Even in areas of abundant harvests, I have always found mushrooms with bluish-green discoloration's alongside others that lacked this characteristic. During the drying process, the blue coloration is preserved, even though some fading may occur.

The historic descriptions of *Psilocybe semilanceata* cited above are so detailed that I cannot add any of better quality. In spite of many opinions in the literature to the contrary, there is a noticeable odor that emanates from damp fruiting bodies that have been opened. This odor is similar to, but weaker than the one associated with *Psilocybe bohemica,* which is often described as reminiscent of radishes or poppies, but as generally not unpleasant (also see Chapter 3.2).

In addition, the mushrooms have another special attribute that rarely occurs in other species. Under the light of a quartz lamp, *Psilocybe semilanceata* specimens turn fluorescent. The substance responsible for this phenomenon, however, has not yet been identified.

Accounts of Impressive Experiences

Psilocybe semilanceata is quite likely the most potently psychoactive mushroom among the European species. The impressive nature and rapid onset of the effects are reflected in the description of an intoxication from England cited above. These elements are also part of the following account, which details a mycologist's first self-experiment:

After ingesting 1.3 g (less than one-sixteenth of an ounce) of dried and pulverized mushrooms (30 mushrooms total) in water on an empty stomach, 20 minutes passed before the sudden onset of hallucinatory effects, including a heavy flow of tears. The apparitions are best described as a conjunction of visions and

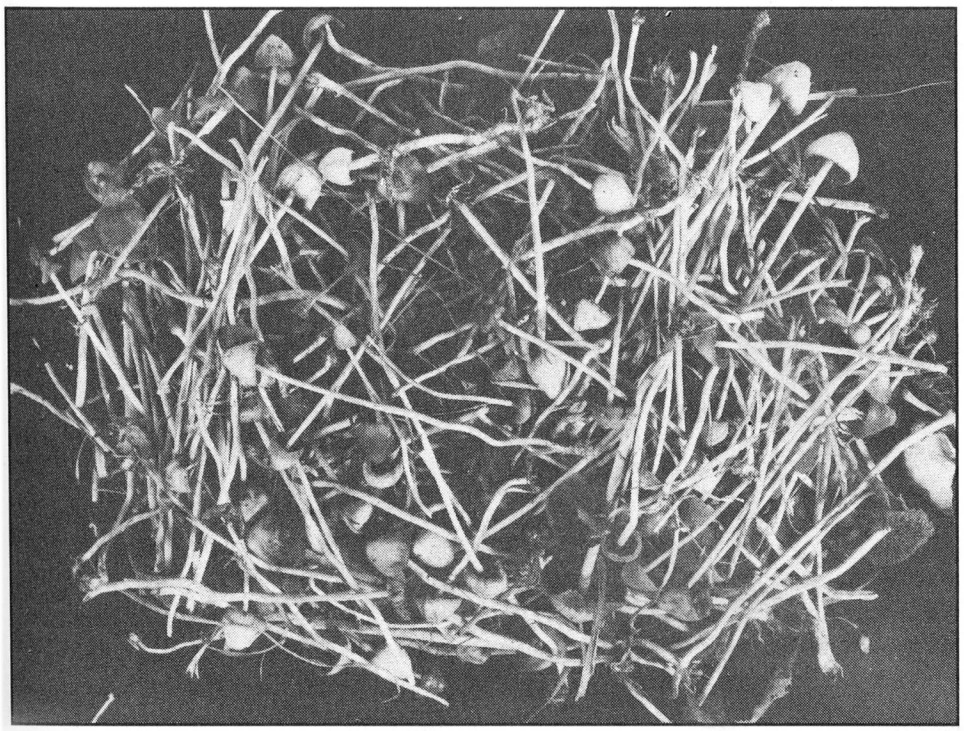


Figure 15 - Harvest of 491 *Psilocybe semilanceata* mushrooms from a single location (Eastern German marshlands, 1989).

Figure 16 - A good description of *Psilocybe semilanceata* from Saxony, Eastern Germany (1952).

a) Oberholz, Ndw., auf breitem Wiesenstreifen am Wege, zahlreich. 5. 11. (6° C). — b) Cradefeld, Lbw., im Grase unter *Quercus*, *Acer*, *Betula*, *Corylus*, sehr gesellig. 27. 9. — c) Wolftitz (»Streitwald«), auf grasigem Weg, mehrfach. 8. 10. Z. — d) Denkwitz, zerstreut auf sandiger Wiese, sehr große üppige Stücke. 22. 10. Z. C*.-?

Sp Staub purpurbraun; erst grauviolett, dann gelbbraun durchscheinend, länglich elliptisch, mit Keimporus, glatt, 12–16×(6) 7–8; auch 13–15 7–8; sehr massig ausgefallen; auch 11–15×7–8. — Z klein, zahlreich an der Schneide, spindelig-pfriemlich, 18–24 ×4–5 (6).

Beschreibung (komb.): H dauernd spitz, kegelig, höher als breit, z. B. 2 breit ×2,5 hoch, oder 1,5×1,7, oder 1,2×1,5; mit etwas eingebogenem Rand, parabolisch, gelbgrünlich mit bräunlichem Scheitel oder im ganzen leichtbräunlich, schmierig, trocken-glänzend, glatt, kahl, mit leicht abziehbarer Oberhaut, am Rande zart gerieft, ohne Velum, dünnfleischig. — St 8–9× 2–2½; schlank, blaß, bräunlichblaß, nach oben fein weißschuppig, nach unten glatt und seidig-glänzend, gleichdünn, meist wellig verbogen, im Innern weißmarkig (wattig) ausgefüllt, starr, knorpelig. — L olivbraun bis dunkelrotbraun mit weißer, flaumiger Schneide, gedrängt, aufsteigend, schmal, leicht bauchig (lanzettlich), 3,5 : 0,5; bei kleinen Stücken fast linear, angeheftet. — Fl im Hut blaßgelblich, im Stiel bräunlich werdend; ohne auffälligen Geruch und Geschmack.

Abb. 72. *Psilocybe semilanceata* (Fr.) 9/10 nat. Gr., Hab., Sp, Z.

Der »Spitzkegelige Kahlkopf« ist durch die gelblichgrünliche bis olivbräunliche Farbe, die bleibend spitzkegelige Form des Hutes (höher als breit) und die aufsteigenden schmalen Lamellen gut charakterisiert. Das Fehlen des nicht seltenen Pilzes im Verzeichnis der Pilze Sachsens dürfte wohl auf einem Versehen beruhen.

Figure 17 - *Psilocybe semilanceata* on grassy soil.

Figure 18 - *Psilocybe semilanceata* hidden in high grass.

thoughts - later on I discovered the term "visualization" in the literature. I had an extremely uncomfortable experience of a daydream-like flight, where my arm had been seized by a witch... There were three of us flying somewhere, sometime. After that, all objects in my immediate surroundings appeared pale and bleached. With my eyes closed I "saw" abstract ornaments with no distinct luminescence or emotional impact. During this time, free-floating dysphoria developed, along with guilt-ridden ruminations. After five hours, the effects ended suddenly, followed by the gradual onset of a mild headache, while no other side effects were noted.

On the other hand, a second experiment involving about half the previous dosage stood out because of a surge of memories and the simultaneous re-experience of childhood emotions, along with some curious feelings of melting and merging:

One day in late summer I was out on a nature walk and ingested 0.6 g of pulverized mushrooms. The weather was warm and sunny and I was walking through open areas near my hometown, were I had often played as a child. Suddenly, I experienced an emotional state most accurately described as child-like wonder and amazement about the surrounding forest. The area nearby appeared in very sharp contrast and my visual perceptions seemed fresh and pure. Suddenly I remembered in vivid detail just how small the trees had been decades ago and how I never observed any other plant growth there before dark, which had sometimes frightened me. At the same time, my body movements felt much more elastic and childlike. This delightful state of reliving my childhood lasted for about two hours. On the way home I noticed a small calf out on the pasture.

The calf evoked a great amount of empathy in me, when I noticed how much it was bothered by pesky flies. These feelings of compassion culminated in a brief experience of completely merging with the calf. I found it to be rather strange and quite uncomfortable. After four hours, the effects subsided without any lasting side effects.

Finally, a third mushroom experiment with *Psilocybe semilanceata* in Oregon led to an experience of complete identification with a person from the 19th century:

We collected a large number of "liberty caps" in a pasture near Astoria. Later on, back at our lodgings, I ate no more than six fresh mushrooms. The key stimulus for the following experience was provided by a water color painting of an elegant lady from the 19th century that captured my attention completely. Suddenly I knew that I was re-living an earlier incarnation, a life that began when I was born in Germany in 1813.

My name was Alexander Schmitt, and I knew that I had died in 1871. As a child, I travelled by boat to North America, together with my parents and other immigrants. In the United States, 1 changed my last name to Smith. I was a logger in a small Kentucky town named Sharpville or Shopville. My life there was hard and full of sacrifices and I drank a lot of alcohol. These circumstances of my existence were indicative of my lifestyle, which included beating my wife and otherwise mistreating her like the tyrant I was. As the experience deepened, I completely identified with the person of Alexander Smith. During these moments I forgot my native German altogether, and my thinking processes unfolded entirely in English. In this manner, I eventually experienced the last hours of Alexander Smith's life. I was lying in bed on several white sheets and was very ill. Suddenly I knew that my wife had poisoned me, to put an end to my continuous degrading treatment of her over the years. I knew that I did not have long to live. I was about to die. Fortunately, the experience ended before I had to face the final struggle against death. Today, over three years later, this unique experience is still etched into my memory in vivid detail.

The experience's emotional impact has not diminished with the passage of time.

Such experiences of earlier incarnations cannot be explained in terms of the accepted tenets of western science. In any case, a thorough attempt should be made to research the existence and historic accuracy of the locations and persons involved. The individual who experienced the events described above had never been to Kentucky, did not know whether or not a town named Sharpville or Shopville has ever existed there and had never before had the slightest interest in this U.S. state. Due to his strictly atheistic upbringing, he had never thought such experiences possible. S. Grof, however, has described similar sequences and emphasized that they can occur quite unexpectedly under the influence of hallucinogens. He also noted that such experiences are not exactly unusual, when

an individual experiences repeated applications of hallucinogenic substances.

In closing this section, I would like to present a short account of an experience that illustrates how the effects of psychotropic substances can vary across individuals, depending on the setting in which the experience takes place:

After ingestion of 0.6 g of pulverized mushrooms in orange juice, the effects began to manifest after about 30 minutes: An endless sequence of images behind closed eyes. At the same time, no distinctly euphoric nor dysphoric emotional states were noted; the reaction to these images is most fittingly described as "temporary amazement". The initial images of entwined ornaments changed with the passage of time and became plants, some of whom had several surreal characteristics not known to exist on Earth. I believe these images reflected my longstanding preoccupation with the world of plants. Then, when a mirror was placed in front of me, I perceived "a gloomy-looking fellow with a fixed gaze". Then I admitted, somewhat reluctantly, that this impression did, in fact, reflect my everyday demeanor and that I usually did not make it easy for others "to see behind the facade ". The experimental guide confirmed my own impressions. Prior to this incident, we had never discussed this issue.

The Psychotherapeutic Potential of Psilocybin's Psychotropic Effects

The preceding account of an experience by a 67-year-old mycologist contains elements that illustrate the beneficial potential of psilocybin's psychotropic effects as an adjunct to psychotherapy. We will return to a discussion of these benefits in Chapter 9.

In accordance with their strong psychoactivity, chemical analyses of *Psilocybe semilanceata* specimens have revealed high levels of psilocybin. It is safe to say that this species has been more thoroughly studied than any other *Psilocybe* species, including the Mexican species, whose dried mass is known to contain 0.2 - 0.6 psilocybin.

Collections of *Psilocybe semilanceata* from England, Scotland, Norway, Finland, Belgium, Holland, Germany, France, the United States as well as from Switzerland and the former Czechoslovakia have, for the most part, been extensively analyzed. It was discovered that the combined analysis of several dried mushrooms for alkaloid content yielded an average value of 1 % psilocybin of the dry weight, regardless of country of origin. The issue of chemical race has been hotly debated with respect to other species, such as the fly agaric mushroom. But in contrast to plants, such a phenomenon has not yet been proven to exist in the higher mushroom species. So far, there is no evidence to support the notion that the basic chemical make-up of a species can vary dramatically from sample to sample. Among the species discussed here, *Psilocybe semilanceata* and *Inocybe aeruginascens* (see Chapter 3.4) appear to be the two species with the lowest degree of variability in psilocybin content across samples. The first three analysis results shown in Table 1 represent data from my own research conducted in the course of a workshop with other investigators in Prague.

TABLE 1

Average Psilocybin Content of Dried *Psilocybe semilanceata* Samples

Origin	Psilocybin (%)
1. Dubener Marshlands, Eastern Germany	0.96
2. Prague, Czech Republic	1.05
3. Krasna Lipa, Czech Republic	0.91
4. Norway	0.95
5. Pacific Northwest, USA	0.93
6. The Netherlands	0.97

Fresh mushrooms are about 90% water, that is, one gram of mushroom material contains an average of 1 mg of psilocybin.

Psilocin, a comparatively less stable compound, is the phenol analogue of psilocybin (see Figure 19, p. 27) and thus oxidizes much more readily than psilocybin. *Psilocybe semilanceata* contains only trace amounts of psilocin, if any at all.

On the other hand, baeocystin as the

Biochemical precursor of psilocybin is found in all fruiting bodies of the *Psilocybe* species. The precursor has a hydrogen atom where psilocybin's only CH_3 group is located; the average baeocystin content is 0.2% of dry weight. In 1967, Leung and Paul reported the isolation of baeocystin from fruiting bodies of *Psilocybe baeocystis Singer & Smith* in North America. In 1977, Repke and Leslie also found the substance in a *Psilocybe semilanceata* sample from the same place of origin.

Some investigators have found differences in alkaloid content when comparing single fruiting bodies from the same location

TABLE 2

Alkaloid Content of Dried Mushrooms from a Location in the Dubener Marshlands of Eastern Germany (Selected Results)

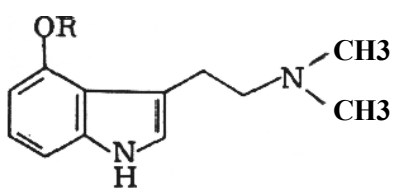
Dry Weight (mg)	Psilocybin (%)	Baeocystin (%)
18	1.25	0.34
30	0.96	0.21
70	0.72	0.19
85	0.90	0.10

Smaller mushrooms almost always contained more alkaloids than larger specimens. This fording was then confirmed by another study using considerably larger amount of investigative materials (40 mushrooms). Moreover, exceptionally high concentrations of baeocystin have been shown to accumulate in the caps of fruiting bodies that contain the alkaloid. In addition, one mushroom sample from Finland deserves special mention due to its unusually high psilocybin content of 2.37%!

Early controlled studies of the psychoactivity of various species in the former Czechoslovakia concluded that *Psilocybe semilanceata is* a more potently psychoactive species than *Psilocybe bohemica,* even though both species were found to contain the same amounts of psilocybin. Thus, researchers hypothesized that the mushrooms are likely to contain additional substances that contribute to the overall psychotropic effect. This hypothesis is supported by the fact that considerable amounts of baeocystin are consistently found in samples of *Psilocybe semilanceata. I* am also aware of an experiment whose results showed that 4 mg of baeocystin caused mild hallucinations for three hours, while 10 mg of baeocystin were found to be about as psychoactive as a similar amount of psilocybin.

The Long Shelflife of Psilocybin

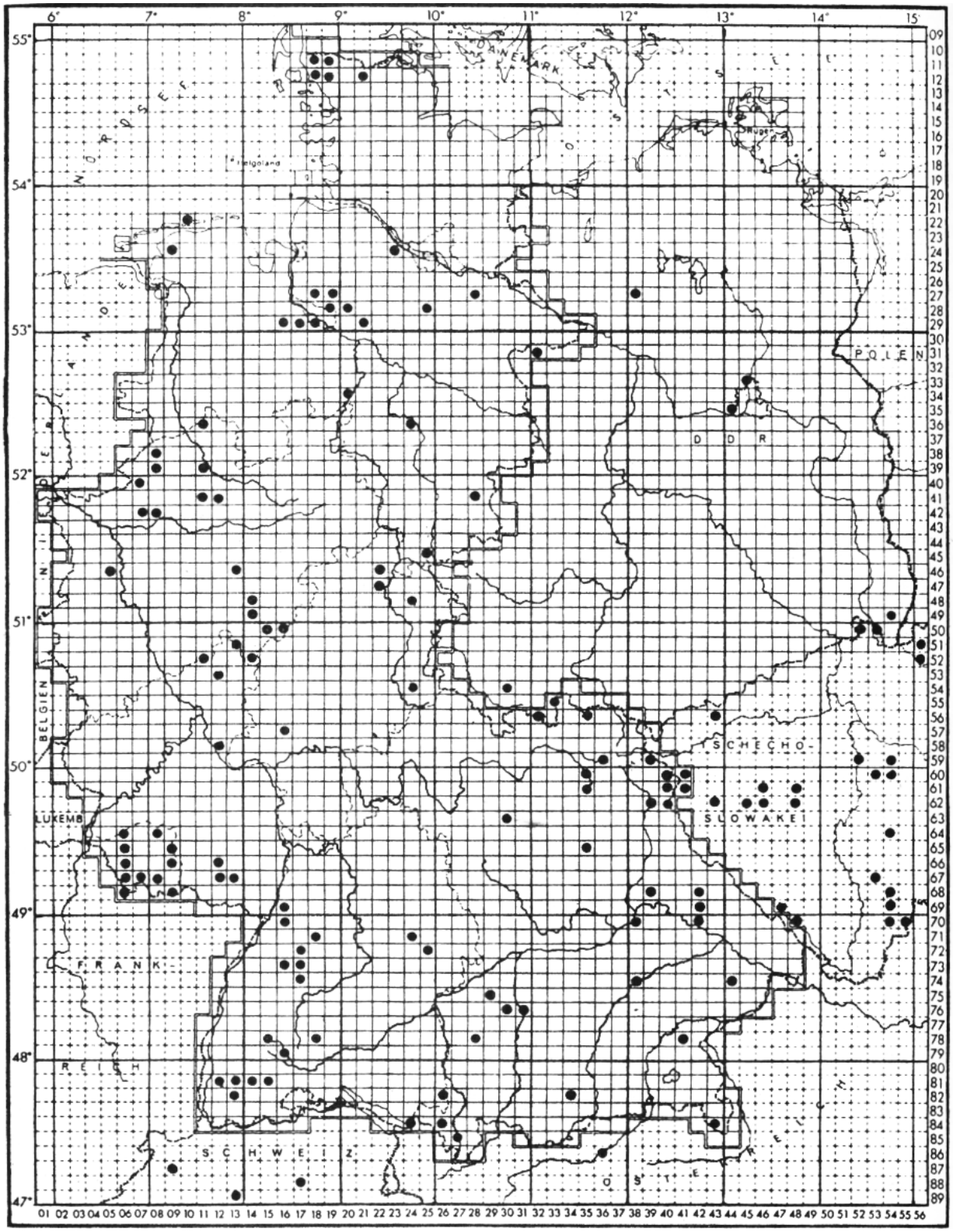
As part of dried mushroom material, psilocybin is a remarkably durable substance. A sample of desiccated mushrooms dated 1869 from a Finnish herbarium was still found to contain 0.014% of psilocybin. On the other hand, no alkaloids were founds in another sample dated 1843. Unfortunately, it is no longer possible to determine the methods used in drying these samples. Temperatures over 50°C cause psilocybin to break down into its derivatives. In laboratory settings, mushrooms are usually dried at room temperatures. Sometimes, fruiting bodies are also freeze-dried for analysis. Freeze-dried mushrooms, however, have a highly porous texture that causes the alkaloids to break down relatively quickly, if the samples are stored at room temperature (20°C). For that reason, freeze-dried samples for biochemical analysis are stored at -10°C prior to alkaloid extractions or chromatography testing. In addition to the reports from Finland, investigators in North America have noted that psilocybin's decay rate is slowest in *Psilocybe semilanceata,* compared to other species.



(1) R = H2P03

(2) **R = H**

Figure 19 - Structural formulas for psilocybin (1) and psilocin (2).



Psilocybe semilanceata

Figure 20 - Distribution pattern of ***Psilocybe semilanceata*** in Germany and adjacent areas. Locations are indicated by black dots.

CHAPTER 3.2

PSILOCYBE CYANESCENS - POTENT MUSHROOMS GROWING ON WOOD DEBRIS

At least one other *Psilocybe* species in addition to *Psilocybe semilanceata is* known to exist in Europe. At this point, I must emphasize that the differentiation of single species within the *Psilocybe* genus is subject to considerable controversy among eminent taxonomists. For example, there are different methods of distinguishing the *Hypholoma* genus from the Stropharia genus.

The Widespread Distribution of *Psilocybe cyanescens*

While *Psilocybe semilanceata is* a species that has long been clearly defined and is well known by this name, there are, according to Krieglsteiner, other strongly bluing mushrooms that can be described as belonging to the *"Psilocybe cyanescens* complex". These are all mushrooms that grow on raw compost and plant debris.

In accordance with current states of knowledge, the following names in the literature are merely synonyms for *Psilocybe cyanescens Wakefield emend. Krieglsteiner:*

- *Hypholoma cyanescens R. Maire*
- *Hypholoma coprinifacies (Rolland ss. Herink) Pouzar*
- *Geophila cyanescens (R. Maire) Kuhner & Romagnesi*
- *Psilocybe serbica Moser & Horak*
- *Psilocybe mairei Singer*
- *Psilocybe bohemica Sebek*

The classification of these synonyms is particularly difficult, because the mycologists involved provided detailed descriptions for isolated collections of fruiting bodies only, followed by comparisons with mushrooms found at other locations, using dates provided in the literature. Under the best of circumstances, an analysis was performed on dried samples from different herbariums. However, the microscopic data pertaining to the *Psilocybe* species are poorly delineated and oftentimes overlap. It is therefore imperative that additional mycological studies of *Psilocybe cyanescens* be performed. To this end, fresh mushroom samples from various European locations should be used, and biochemical methods must be included in the investigation. Guzman's division of *Psilocybe cyanescens* by geographic area, however, definitely turned out to be inaccurate. According to his system, North Africa was home to *Psilocybe mairei,* while *Psilocybe cyanescens* were found in England and Holland and *Psilocybe serbica* supposedly grew in Serbia and Bohemia. The geographic distribution of the entire species seems to cover a vast area, with variations along climate and terrain at locations where samples were collected. Such disparate morphologies are to be expected when dealing with "young" species, that is, species that have not yet firmly established themselves and are still expanding into new locations.

Figure 7 (p. 14) displays locations in Europe and North Africa where samples of *Psilocybe cyanescens* have been found.

Spores Introduced From Overseas?

In this section I would like to discuss several aspects of the bluing *Psilocybe* mushrooms. Detailed information about several isolated sample collections has been presented by Krieglsteiner.

A description of any mushroom species becomes valid only after a Latin diagnosis of the collected sample has been published in a mycological journal, along with distinctive characteristics in relation to other species.

In 1946 Wakefield described as *Psilocybe cyanescens Wakefield* a sample of bluing dark-spored mushrooms collected at the botanical gardens in Kew, England. It had been suggested

that those mushrooms occurred adventitiously, that is, that the spores had been imported from overseas together with other plant materials. The presence of such mushrooms in botanical gardens had been observed quite frequently, and such imports are likely whenever the mushroom in question has never before been found in surrounding areas. The possible importation of *Gymnopilus purpuratus* is described elsewhere (see Chapter 3.5).

The mushrooms displayed a much more intense blue staining reaction than *Psilocybe semilanceata.* They were observed growing on small pieces of wood in the forested areas of Kew Gardens during the fall season for several years. Among the mushrooms' most notable features are their undulating, twisted caps. Guzman believes that specimens collected in British Columbia and the Pacific Northwest of the United States (Northern California, Oregon, Washington) are identical to those found in Kew Gardens (see Figure 24). Indeed, all of the macroscopic and some microscopic descriptions and photographs match the mushrooms found in England. However, conclusive proof of identity can be provided only by results from DNA analyses and cross-breeding experiments with single-spore mycelia. I will elaborate on this method in a later section.

In 1975, fruiting bodies of this species were also discovered in Holland. Additional bluing mushrooms growing gregariously on grass and decaying reeds were found in the Jura Mountains of Switzerland in 1972 (MTB 8511). Other samples are known to have been collected in the Steiermark region of Austria in the fall of 1976, as well as on the Mediterranean island of Corsica in 1972 and 1984.

On several occasions, a number of fruiting bodies classifed as *Psilocybe cyanescens* were also discovered in Germany (see Figure 23, p. 32).

More elaborate descriptions of several such collections are provided below:

On October 31, 1983 considerable quantities of fruiting bodies in all stages of development were found in the lower regions of Bavaria (MTB 7542). Interspersed with grass, the mushrooms grew along a 100-yard stretch right next to an old garbage dump forming colonies, some small and others larger, that were partially intertwined. They were found scattered across decaying plant materials, such as leaves, twigs and mulch. There were greenish and distinctly bluish stains on the caps, and most notably a bluish color near the base of the stem. Other fruiting bodies quickly developed blue stains in reaction to being handled, even in very cool temperatures.

The description of *Psilocybe cyanescens* below is somewhat condensed, but essentially applies to all other collections, while the relative measures and sizes may vary:

Caps: 5-40 mm broad, conic at first, with cortinate fibrils ascending steeply to the stem, but fading quickly, bell-shaped later on, partially with an acute umbo. Later expanding to plane, with undulating or wavy margins, no remnants of veil, also broadly convexed to umbonate in older mushrooms. Deep chestnut brown when fresh and moist, fading to a whitish color when drying, with stains of bluish to blue-green coloration.

Gills: Attachment adnate to broadly subdecurrent, color light to dirty beige when young, later on changing to cinnamon-purple brownish color due to maturation of spores. Blue staining reaction is slight in response to pressure.
Stem: 30-85 mm long, uniformally thick at 1.5-3 mm. Stems and mycelial fibers turn blue in response to touch, if blue stains not already present.

Odor: Somewhat like flour or potatoes.
Spores: 6-8 x 9-14 u.

In 1976, bluing mushrooms growing on plant debris were found in the Saarland region of Germany. Other collections came from the Southern regions of the Black Forest (MTB 7515, 1959, 1963), as well as the Vogtland area (1979) and the Rheinland area (MTB 4706, 1982). Similar mushrooms were also discovered near Hamburg (MTB 2428, 1983) and Bremen (1982, 1983). The latter collections are especially interesting, because the greenhouses at the Rhododendron Park and People's Park in those cities provided layers of wood chips during the fall which enabled the mushrooms to fruit much more prolifically (thousands of mushrooms) than they did naturally in surrounding areas, where the species was also fruiting in several locations. These findings most likely indicate the presence of a similar, imported species, because native fruiting bodies require exposure to the shock of colder temperatures of fall in order to develop

from the mycelia. For instance, other wood chipdwelling species have been reported from the Pacific Northwest of the U.S., such as *Psilocybe stundi, Psilocybe baeocystis, Psilocybe pelliculosa* and others (also see Chapter 7.1). *Psilocybe caerulescens Murr.* from Mexico is also related to these species. This was the first *Psilocybe* mushroom to be recognized as psychoactive by Wasson in the course of his selfexperiment on June 29, 1955.

Very little is known about the chemical composition of the collections cited above. I analysed a few mushrooms from collections found in the Rheinland area of Germany in 1989. The results were as follows:

Psilocybin: 0.51 % of dried mushrooms

Psilocin: 0.08 % of dried mushrooms

Baeocystin: 0.04% of dried mushrooms

A few other analyses of German mushrooms yielded similar results. These values were well within the range of concentrations of alkaloids found in Mexican species. The most extensive studies on distribution, psychoactivity and chemical compounds of *Psilocybe cyanescens* complex were conducted in the former Czechoslovakia, where the mushrooms are generally known as *Psilocybe bohemica,* a name which is also used in the text below.

An Amazing Discovery Near Poricko

Kubicka first discovered the species on December 6 and 13, 1942 in the Kresicky Creek Valley village of Poricko v Pozavi near Sazava (Czech Republic). In 1950, mycologist Herink described the mushrooms in detail. He also believes that Fries classified mushrooms of the *Psilocybe cyanescens* complex as *Psilocybe* callosa during the 19th century. On November 11, 1986 I had the opportunity to work with Herink and other Czech mycologists on a mycological field research project at the location, where we found 440 fruiting bodies (550 g or 19.6 ozs). Covering a segment almost two miles long, the species was fruiting among nettles along both sides of the creek on wood chips of Carpinus, *Alnus* and *Salix,* on raw compost mixtures of *Picea, Pinus* and *Larix* needles, as well as on decaying pine cones. Several specimens up to 15 cm (6 in.) tall with caps up to 5 cm (2 in.) broad were found growing on a rotting log whose underside was exposed to the running water. A water-loving *Psilocybe* species, it primarily fruits in late autumn (see Figure 21, below), when short night frosts induce maximum possible fruiting. The brown caps are strongly hygrophanous and their color fades to a white-milky brown when dried. Its odor has been compared to anything from radishes to poppies. In my experience, the odor is highly variable and thus difficult to define. Young, dry mushrooms develop intensely blue stains in response to handling, while older fruiting bodies tend to be found at the location with dark blue stains already in place. It is remarkable that the mushrooms were fruiting at the same location near Poricko for so many years in a row, producing a large number of fruiting bodies each year. Unfortunately, in recent years the location was partially destroyed, due to construction of a road.

By late 1982, the mushroom species had been found at 51 locations in the former Czechoslovakia, with only seven of them located in Bohemia, 40 in Moravia, and four in Slovakia. Elevations vary from 200 m to 700 m (600 ft to 2,100 ft) above sea level, with only two locations known to exist above 700 m (2,100 ft). By this time, 112 collections had been reported, 44 of which came from the classic location near Sazava.

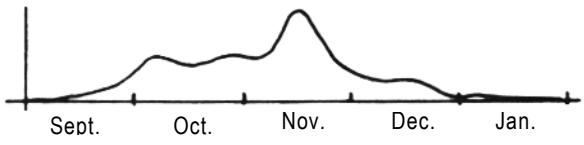


Figure 21 - Fruiting curve of ***Psilocybe cyanescens*** based on observations at several locations in the former Czechoslovakia.

The mycelia make use of different kinds of plant debris and even grow on wet cardboard, where they develop into rhizomorphs just like they would in nature. Rhizomorphs are thick strands of mycelia that serve to transport nutrients and water. They also develop intense blue stains (see Figure 22).

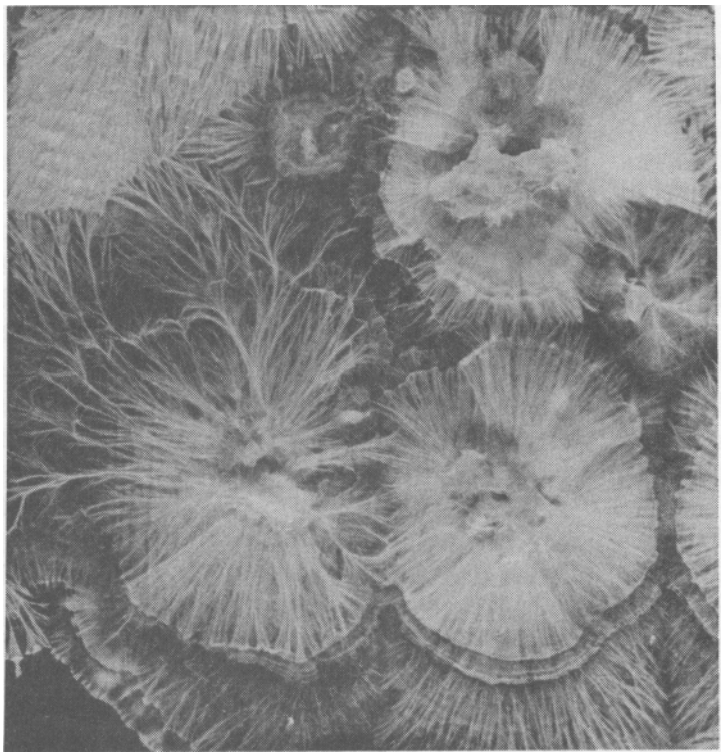


Figure 22
Psilocybe bohemica rhizomorphs growing on wet cardboard.

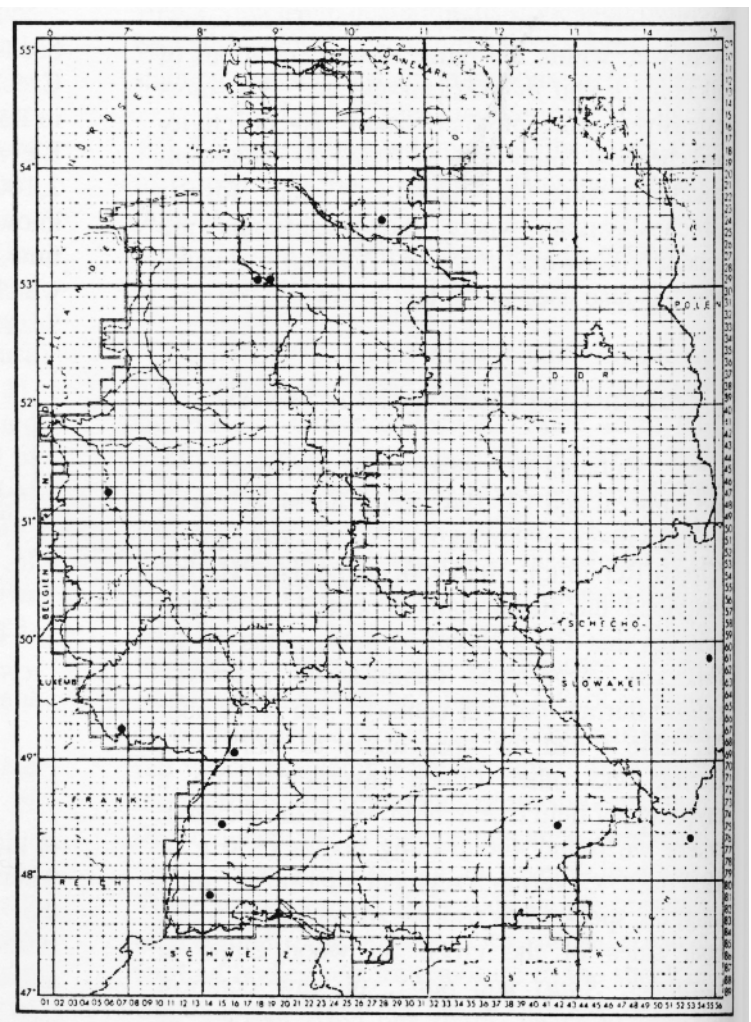


Figure 23
Distribution pattern of ***Psilocybe cyanescens*** in Germany and adjacent areas (according to Krieglsteiner). Locations are indicated by black dots.

Figure 24 - *Psilocybe cyanescens* at a natural location (USA).

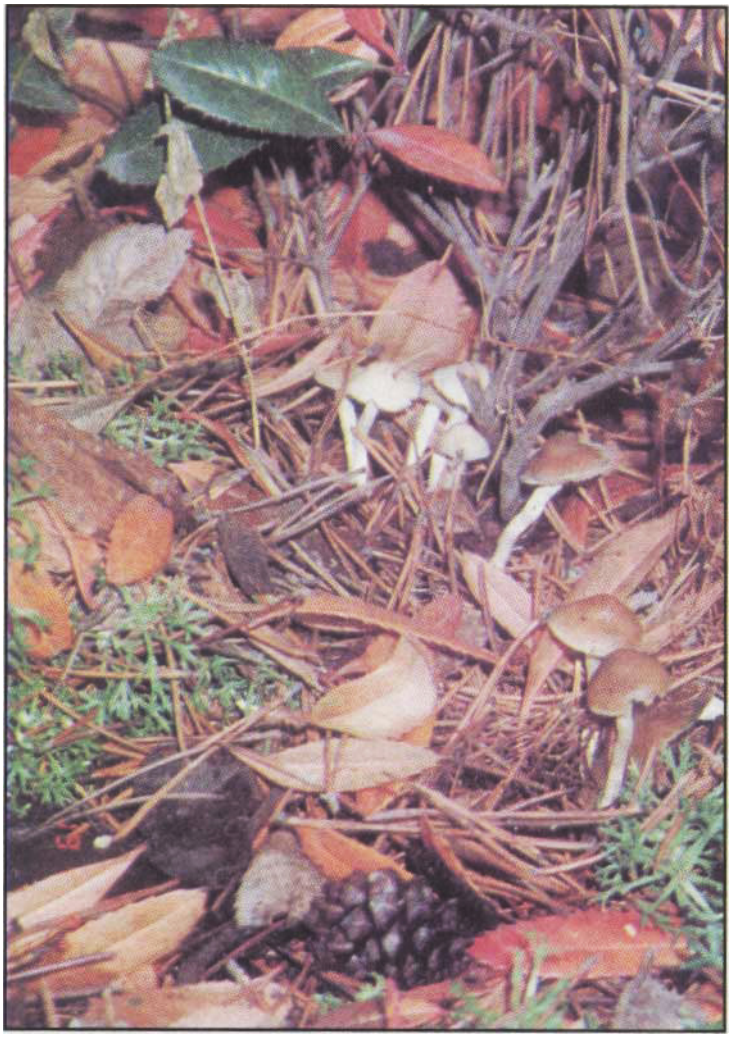


Figure 25 - *Psilocybe bohemica* on twigs and leaves.

Impressive Experiences

Psilocybe bohemica is a very psychoactive species. Its effects are vividly documented in the following account of one natural scientist's experience as part of controlled clinical trials in Prague:

About 30 mg of psilocybin in mushroom tissue was prepared in hot water, with effects already noticeable ten minutes after ingestion. I grew increasingly quiet. At first, my legs began to tingle, then my underarms as well. Aside from a deeper breathing rhythm, few other somatic effects were noted. Initially there were fits of laughter caused by unusual cognitive associations; this laughter also affected the two "sober" guides. A growing hyperacuity interfered with the ability to listen to music, so that Vivaldi's "Springtime" caused painful stabs inside the brain. I compared the pain to that caused by a "sawing knife". The experimenters appeared bloated and yellow... Existing bodily characteristics, such as thinning hair stimulated a person's illusionary transformation into a monk with tonsure. Their voices also appeared reverent and, from a somewhat paranoid point of view, these gentlemen at times seemed to be working a switching station that, for some reasons, was my enemy. At the same time, I found both of them to be quite likeable. During this time period, the other female subject perceived fantastic images of moving colors and saw visions of her whole life unfolding behind closed eyes. During this period, I had the distinct impression that an electrical current was flowing through my body, which was not an uncomfortable sensation. About three hours later, the gentlemen retired to the kitchen and the nature of the experience changed quite drastically.

At first I felt as if my legs were increasingly merging into the wall, a very comfortable experience. In a state of utter clarity of consciousness, I finally felt as if I had no body at all. I said. "The most descriptive expression is the experience of a pure soul". Using words as triggers, we were able to induce shared experiences of color visions and we travelled together around the word as well the spiritual realm. She made a clearly telepathic statement about my hometown, which I could not fathom or interpret at the time, nor could I do so later on. While under the impression that the thinking process itself was something supernatural, I was filled with confidence when I realized without a doubt that death itself was but a levitation of the soul, which may or may not entail looking down *upon the "normal" world. I did, however, anxiously reject her offer to see into my future and tell me about what she learned. Yet 1 knew that she was already seeing such things.*

The above account vividly illustrates the cosmic-mystical aspects of the mushrooms' effects. Such effects have frequently been described following ingestion of high doses of hallucinogens, especially in cautious and protective environments ("setting") coupled with a positive, internal mood ("set") primed by careful preparation. Of course, the detailed content of such experiences varies across individuals. Pahnke's masterful study during Good Friday Services in 1962 has become a famous event in the history of research into these states of consciousness.

Three years later, a remarkable range of effects was observed in the same participant of an experiment conducted in Prague, where mycelia from *Psilocybe bohemica* were used. Due to an analytical error, the four participants each ingested 72 mg of psilocybin, plus some psilocin, instead of the intended dosage of *30* mg of psilocybin each:

Days before the experiment, I already began to suspect that this experience would not evolve as smoothly as it had three years ago, given the amount of personal stress I had suffered over the previous two months. However, I had faith in the expertise provided by psychiatric guidance. Prior to the experiment, I asked the psychiatrist about the possible causes underlying my seeming inability to fully experience the unfolding of visual imagery. He brushed aside my question with a short and terse reply : "Resistance", which only heightened my feelings of anxious tension.

After ingestion of the hot preparation, fifteen minutes passed until the sudden onset of its effects. I ceased to perceive the music and sank into an autistic state devoid of visions which lasted for three hours. This state was subjectively experienced as one of confusion with a partial loss of consciousness as well as the loss of a sense of time and place. This torturous period,

however, did not include any rough somatic disturbances. After I woke up, I felt like a broken machine; only the compassion of the other participants, which were also suffering, helped to clear my head temporarily. My experimenter attempted to counterbalance these effects and to provide a firmly grounded focus of reality, but his efforts were unsuccessful in the long run. I felt as if I was extremely drunk, except there was none of the aggression typical of alcohol intoxication. Soon afterwards, I began to project my emotions onto the psychiatrist. I saw him undergo illusionary changes; initially he appeared to be a dominant rooster which transformed into a punk rocker. Then 1 felt that he would understand what 1 was going through, given his extensive background and experience with psycholytic therapy. So I asked him, if the two of us could retire to another room. When he consented, I began to undergo a psychic split. The sound of my voice was strange and whiny. I felt as if part of me had split off and become an observer, while the rest of my prone body had assumed the position of an infant, sucking on a finger and crying, crumbling up tissue papers at the same time. On the psychoanalytic level, an extraordinary experience began to unfold. I became conscious of all recent and past conflicts, especially those involving my parents. This part of my personality articulated and worked through the emerging conflicts. Even though one might assume this process was facilitated by the psychiatrist, this was not the case. In the semi-darkness 1 perceived him as my deceased grandfather, as a human skull and as an American football player, whose armor I recognized as a projection of my own uptight personality.

Afterwards I looked at my reflection in a large mirror and reconciled my differences with myself as the two halves of my personality merged into one. I saw a soft and tearful face and soon realized that the person I was looking at was none other than myself, that I had learned to accept myself, in spite of all my problems. At the time I also noticed that my self-disciplined behavior was overly exaggerated, a trait generally judged as unfavorable by those around me. I resolved to become more relaxed and carefree in attending to my daily routines. I believed this psychological insight to be a revelation. With my eyes closed, I saw images of translucent vessels atop a brilliantly blue surface. In the weeks and months after the experiment, those around me noticed that my behavior had changed to become more relaxed, which was mentioned spontaneously on several occasions.

The experience of an initial, painful delirium illustrates a resistance to dealing with the conflicts that invariably emerge in response to high dosages - conflicts that were resolved through an intense psycholytic catharsis (also see Chapter 9). A psychedelic experience ensued as both parts of the divided personality were merged into a whole. This is a decidedly positive outcome of a psycholytic episode with corresponding therapeutic benefits - a result that was entirely unintended (!). Personal stress prior to the experiment apparently facilitated the manifestation of deep-seated conflicts and issues that might otherwise never have been dealt with. With the exception of the attending psychiatrist, outside observers appraised this experience as a "bad trip". The subject, however, thought the experience to be enlightening and illuminating, even five years after it took place. Grof describes very similar reactions to LSD therapy. After "going through Hell", subjects proceed to re-integrate their personality at a higher level of consciousness, while experiencing visionary images of clear, bright lights and illumination.

TABLE 3

Concentrations of Psilocybin and its Derivatives in *Psilocybe bohemica (%* of Dried Mushrooms)

Specimen #	Weight (mg)	Psilocybin	Psilocin	Baeocystin
1	31	1.34	0.00	0.01
2	90	0.94	0.01	0.01
3	104	0.41	0.00	0.02
4	175	0.90	0.00	0.01
5	200	0.71	0.01	0.02
6	220	0.37	0.00	0.01

Distribution Patterns of *Psilocybe cyanescens* in the Wake of Environmental Changes

In 1973, Semerdzieva and Nerud first reported the existence and qualitative content of psilocybin in collections of *Psilocybe bohemica.* This research team reported psilocybin levels of up to 1.1 % in dried samples. Results from my own studies also revealed variable levels of alkaloids in different mushrooms collected at the one location near Sazava.

In spite of the intense blue staining reaction, there is very little or no psilocin in mushrooms of the European *Psilocybe cyanescens* complex. By chemical-taxonomic standards, European collections are very different from *Psilocybe cyanescens* samples collected in the Pacific Northwest of the United States. The latter are known to contain up to 1 % psilocin (dried mushrooms) as well as an equally high level of psilocybin (for a total alkaloid level of 2 %), making it one of the most potent species in North America. The study of extracts derived from these mushrooms revealed that enough psilocin was present for the oxidized compound to be visible on a thin-layer chromatography plate. This was not the case when similar analyses were performed on mushrooms collected in the former Czechoslovakia. However, mushrooms from both countries contain similarly low levels of baeocystin.

Generally we can say that this potently psychoactive and conspicuous species is in the process of expanding its habitat across Europe. Increasing use of fertilizer, the acidification of the soil in many regions and the presence in any wet forest or park of a variety of fertile substrates, such as mulch, not dependent on the presence of dung, are all factors that will likely help *Psilocybe cyanescens* achieve a remarkably wide area of distribution in the future.

Figure *26* - *Psilocybe bohemica* on twigs and compost.

CHAPTER 3.3

PANAEOLUS SUBBALTEATUS - MYCOLOGY AND MYTHS ABOUT THE PANAEOLUS MUSHROOMS

Stories about involuntary intoxications with the dark-spread dung-inhabiting mushrooms (genus *Panaeolus)* in various regions of the world have been in circulation since at least the early 19th century. *In 1816, an impoverished man collected mushrooms in London's Hyde Park which he thought to be edible white mushrooms ("champignons ", Agaricus bisporus). Soon after ingesting these mushrooms, his field of vision darkened and he saw fog while feeling lightheaded and dizzy.*

Trembling, he sank into his chair. He felt all his strength draining from his body and he grew oblivious to his surroundings and no longer knew where he was. Some time later, the feelings of dizziness subsided, and his heart rate slowed down until he was finally able to fall asleep.

The symptoms were later attributed to *"Agaricus campanulatus Linnaeus ",* which the man had mistaken for champignons. The same species had been responsible for a similar case of intoxication that happened about a year earlier. Both accounts are highly reminiscent of the 1799 intoxication with *Psilocybe semilanceata* from St. James Green Park (see p. 15). This would seem to be quite logical, as there are psilocybin-producing mushrooms even among the genus *Panaeolus.* However, the question which of the 15 European species actually produce the psychoactive substance is an issue that remains the subject of considerable scientific controversy. Even though I cannot offer any decisive or final evidence towards the resolution of this problem, there are some fairly conclusive results from modern biochemical analyses (see Table 4 below) of mushrooms that were clearly identified or obtained from herbariums, where certain species were known to have been deposited. Specifically, many American species within the genus *Panaeolus* do not appear to be the same as European species with the same name.

At this point, I would like to present some historic cases of *Panaeolus* intoxications. A typical hallucinogenic experience blamed on the accidental ingestion of *Panaeolus papilionaceus (Bull.:Fr.) Quel.* occurred in Maine, USA, in 1914.

Below is an abridged version of the description of effects by a Mr. W.:

On July 10, 1914, 1 gathered a good mess of the mushrooms (Panaeolus papilionaceus) and had them cooked for dinner. .... They were all eaten by Mrs. Y. and myself. Peculiar symptoms were perceived in a very short time.... A little later, objects took on peculiar bright colors. A field of redtop grass seemed to be in horizontal stripes of bright red and green, and a peculiar green haze spread itself over all the landscape... Soon both of us became very hilarious, with an irresistible impulse to laugh and joke immoderately, and almost hysterically at times.... I then had a very disagreeable illusion. Innumerable human faces, of all sorts and sizes, but all hideous, seemed to fill the room and to extend off in multitudes to interminable distances, while many were close to me on all sides. They were all grimacing rapidly and horribly and undergoing contortions, all the time growing more and more hideous. Some were upside down. The faces appeared in all sorts of bright and even intensive colors - so intense that 1 could only liken them to flames of *fire, in red, purple, green and yellow colors, like fireworks.... The entire experience lasted about six hours. No ill effects followed. There was no headache, nor any disturbance of the digestion.*

During the winter of 1915, a species of *Panaeolus* spontaneously appeared in a mushroom greenhouse in New York. These fruiting bodies were accidentally eaten together with the champignons that were cultivated there. This error led to cases of intoxications so remarkable that Murrill described the mushroom as *Panaeolus venenosus.* Some time passed before it was discovered that this species had previously been described as *Agaricus*

subbalteatus B. & Br. from England in 1861. The combination term that is in use today, *Panaeolus subbalteatus (B.& Br.) Sacc.* was first published in 1887.

Other cases of intoxications with similar symptoms caused by the *Panaeolus* species have been reported in the United States (1917), as well as from Australia (after 1940), where the species involved was described as *"Panaeolus ovatus Cooke & Massee".*

In 1939, these reports induced Schultes, in agreement with Linder's classification experiments, to publish as *Panaeolus sphinctrinus (Fr.) Quel.* the *teonanacatl* mushroom described in the Mexican literature from the 16th and 17th centuries.

However, Wasson, Heim and their collaborators, as well as Singer, were unable to document the usage of *Panaeolus* mushrooms in Mexico, in addition to their reports about the usage of psychoactive *Psilocybe* species from the 1950s. By 1959, even Guzman referred to this species as "the false teonanacatl". So far, he has been unable to document native usage of any *Panaeolus* species in Mexico. In fact, the natives of Mexico consider bluing, hallucinogenic *Panaeolus* mushrooms to be poisonous.

Despite the poisoning case reported in England, the early German literature does not classify *Panaeolus* species as poisonous (see Figure 27). The *Psilocybe* species were treated similarly.

Figure 27 describes the mushroom's characteristics as accurately as Figure 3 (p. 6) depicts its habitus. More recent descriptions are usually less detailed and thorough than Michael & Schulz's from 1927.

In Germany, a case of intoxication with *Panaeolus* mushrooms was first reported in 1957 (see Figure 28). From today's perspective, it appears that the mushroom responsible for the intoxication was most likely *Panaeolus retirugis (Fr.)* Gill.

About 30 to 60 minutes after ingestion of the cooked mushrooms, the woman's field of vision began to quiver increasingly. At the same time, her pupils were extremely dilated. As she began to have difficulties breathing, she suffered a full-fledged anxiety attack. All objects appeared as if obscured by curtains. After the effects had subsided, no symptoms of lasting damage could be detected.

In 1970, another poisoning case with *Panaeolus subbalteatus* occurred in Leipzig. Similar to the 1915 incident in New York, the mushrooms spontaneously emerged among a culture of artificially cultivated mushrooms *(Stropharia rugoso-annulata Farlow,* in this case) and then were eaten by mistake. The description of its effects is somewhat peculiar.

Growing on Dung, Manure and Compost

The stories about intoxications as well as the very name "dung-inhabiting" mushroom offer clues about the kinds of habitats this species prefers to grow in.

At times, they grow directly on top of dung or on pastures that have been heavily fertilized. They are also found on trash heaps, on compost or on straw substrates where mush rooms are commercially cultivated. European *Panaeolus* species that produce psilocybin have a special attribute that differentiates them *Psilocybe* species: they very seldom develop blue stains when handled or injured.

In his description of a Scottish case of intoxication in 1977, Watling mentions marked blue colorations along the caps of stems of *Panaeolus subbalteatus,* which also developed in reaction to pressure. According to my observations, the formation of blue stains is very rare. Reports from the Pacific Northwest United States also state that only one in a hundred mushrooms actually turns blue.

One controversial issue in the literature concerns the toxicity of one species: *Panaeolus foenisecii (Pers.:Fr.) Kuhn.* This species has previously been classified as *Psilocybe* as well as *Psathyrella,* and has been described as *Panaeolina* in contrast to *Panaeolus,* because it is a species that does not grow on dung, fruits only after the hay harvest, and develops spores that are purplish-brown and abrasive. Other *Panaeolus* species, however, have black spore prints when placed on white paper underneath a glass vessel to prevent dehydration. But, even the spores of *Panaeolus foenscecii (Pers..-Fr.) Kuhn.do* not all ripen at the same time, which can cause the gills to appear mottled.

Due to the complications with taxonomic differentiation, there are certainly no reliable

192. Gezonter Düngerling. Wertlos. Panäeolus subbalteátus Berk. u. Br.

Der Hut iſt flachglockig, ſtumpf, in der Mitte öfter etwas gebuckelt, meiſt 3 bis 4, manchmal auch bis 5 cm breit, hygrophan, im feuchten Zuſtande rotbraun, trocken blaß, bräunlich-fleiſchfarben, am Rande eine Zeitlang durchwäſſert dunkler gezont, glatt oder etwas runzelig, kahl, ſchleierlos, ziemlich fleiſchig.

Die Blätter ſind erſt rotbräunlich, ſchließlich rußig-ſchwarz, ziemlich gedrängt, bauchig, 7 bis 8 mm breit, dicklich, am Stiel angeheftet, ſpäter von ihm getrennt.

Die Sporen ſind faſt zitronenförmig, 13 bis 14 μ lang und 8 bis 9 μ breit, glatt, ſchwarz, undurchſichtig.

Der Stiel iſt ſchlank, faſt gleichmäßig dick, oft verbogen, 4 bis 8 cm lang und 3 bis 4, ſeltener bis 5 mm dick, rotbräunlich, ſeidig-faſerig, nur oben ſchwach bereift, engröhrig-hohl, zerbrechlich.

Das Fleiſch iſt blaß, geruchlos und von mildem Geſchmack.

Zeit und Standort: Der Pilz wächſt von Juni bis Oktober büſchelig, faſt raſig, an grasigen Orten, beſonders üppig auf gedüngten Äckern, kommt aber ſeltener vor.

192. Panaeolus subbalteatus Berk.u.Br.

The cap is broadly convex, obtuse, often with a slight umbo in the middle, usually 3-4 cm broad, sometimes up to 5 cm. Hygrophanous, reddish brown when wet, pale and brownish to flesh-colored when dry. Margins moist to watery at times, and banded with a dark brown stripe around the edges. Surface smooth or lightly wrinkled, bald, rather fleshy, no veil.

The gills are reddish brown when young, later on sooty or black, gill spacing is rather crowded and bulgy, gills are 7-8 mm wide and somewhat thick. Gills are initially attached to the stem, and detached later on.

The spores are almost lemon-shaped, 13-14u long and 8-9,u wide, smooth, black and opaque.

The stems are slender, 4-8 cm in length and uniformly thick (3-4 mm, sometimes up to 5 mm). Stems are often curvy and reddish brown in color; silky-fibrous with a slight ring at the top. Stems are narrowly tubular and break easily.

The flesh is pale and odorless with a mild taste.

Habitat and season: The mushroom grows cespitosely to gregariously from June through October in grassy areas. It particularly thrives on fertilized fields and pastures, but occurs there comparatively less often.

Figure 27 - Description *of Panaeolus subbalteatus* by Michael & Schulz from 1927 (with English translation below).

Eine Düngerlingvergiftung in Bremen

Von W. Neuhoff

Vergiftungen durch die schwarzsporigen Düngerlinge (*Panaeolus*) kommen anscheinend nur selten vor. Bekanntgeworden sind bisher vereinzelte Fälle aus Nordamerika und England. Die Schilderung des Krankheitsverlaufes geht im wesentlichen zurück auf Louis C. C. Krieger – »A popular guide to the higher fungi (mushrooms) of New York State«, 1935, S. 147 –, der die Symptome als ähnlich denjenigen einer Alkoholvergiftung beschreibt: Schwierigkeiten beim Stehen und Gehen, unzusammenhängendes und unangebrachtes Reden und Lachen, visionäres Schwanken oder Tanzen von Gegenständen der Umgebung. Hinzu kommen bemerkenswerte Halluzinationen prachtvoller Farbenzusammenstellungen. Äußerlich besonders auffallend sind die geröteten Augen und die Erweiterung der Pupillen.

Figure 28 - First description *of* a *Panaeolus* intoxication in Germany (1957). Symptoms are compared *to* those *of* alcohol poisoning, such as difficulties standing or walking, incoherent or inappropriate laughter and talking, and visions *of* objects moving or dancing. Other symptoms include remarkable hallucinations with splendid color combinations, as well as red eyes and dilated pupils.

Figure 29 - *Panaeolus cyanescens* in Hawaii (USA).

Figure 30 - *Gymnopilus* purpuratus on sawdust.

maps showing distribution patterns for the European *Panaeolus* species.

Taxonomic Confusion

On May 25, 1986, in the village of Heringsdorf on the Eastern German Sea Coast, I found 147 fruiting bodies of *Panaeolus subbalteatus* in all stages of development. They were growing on a compost heap that originally contained horse manure. Unlike the *Psilocybe* species, *Panaeolus* mushrooms can be found anytime from spring throughout the fall season. The differentiation of *Panaeolus* species is further hindered because they are very hygrophanous, with caps whose colors can change from whitish to grey, or from reddish brown to a very dark black-brown. Older mushrooms on the compost heap had caps that had cracked with age, and margins that had curved upwards and were covered with spore dust. Only two mushrooms had blue-stained caps, and the stems did not change color in reaction to pressure. In the American literature *Panaeolus subbalteatus* has been labeled *"Panaeolus variabilis",* because some of the stems imitate the appearances of other mushroom species and thereby contribute to the taxonomic confusion. The species is also known to grow in the immediate vicinity of *Panaeolus foenisecii (Pers.:Fr.) Kiihn.,* creating more opportunities for mistakes, especially if the mushrooms are not closely inspected. The caps *of Panaeolus subbalteatus* become flat as the mushrooms age, a feature that is taxonomically significant.

The cap's long, watery marginal zone gives the mushroom its name. Only the psilocybin-producing species will be discussed in more detail below. Results from recent comprehensive analyses clearly show that *Panaeolus subbalteatus is* the most important psychoactive European species among the genus *Panaeolus.* Ola'h's world monograph about the genus *Panaeolus* was published in the 1960s and has caused much confusion, since he described a number of species as "latent psilocybin-producers". He proposed, for example, that *Panaeolus foenisecii* occasionally produces psilocybin. All *Panaeolus* species share one characteristic that differentiates them from all other species discussed in this book: They produce 5-substituted indole compounds, such as serotonin and its biochemical precursor, 5hydroxy-tryptophan. Serotonin is a compound widely found in animals and humans. It acts as a neurotransmitter in the brain, even though not all of serotonin's effects have been entirely understood. It should be noted, however, that both serotonin and 5-hydroxy-tryptophan are completely inactive when taken orally. When performing paper or thin-layer chromatographies, both of these substances can easily be mistaken for psilocin. It is remarkable that Ola'h's results contradict current findings, in that his data frequently showed the existence of psilocin in *Panaeolus* species!

More recent studies of carefully identified mushroom material from the European *Panaeolus* species did not document substantial amounts of psilocin in these samples. Also, "chemical races" associated with specific species could not be established. I believe that almost all accidental intoxications can be traced to ingestion of *Panaeolus subbalteatus,* with the possible exception of one case caused by an imported tropical species. Very little is said in the literature about *Panaeolus retirugis,* its area of distribution and chemical composition. The intoxication case from Bremen, however, indicates that this species is psychoactive (see Figure 28). In 1985, I found two fruiting bodies in a pasture, whose dried weight contained 0.03 - 0.05 % psilocybin, as well as serotonin. All of the mushrooms' features, such as wrinkled, fleshcolored caps, corresponded to descriptions of *Panaeolus retirugis.*

Based on his analyses, Stijve concluded that the dried fruiting bodies of *Panaeolus subbalteatus* contain about 0.1 % psilocybin, regardless of location, as well as a tiny amount of baeocystin. Still, accounts of intoxications with consistently potent psychoactive effects would seem to provide evidence against such small amounts of alkaloids in *Panaeolus subbalteatus.* Indeed, dried mushrooms from the Pacific Northwest region of the United States have been reported to contain 0.16% - 0.65% psilocybin. Moreover, the first analyses of the species in North America (1959) led to the isolation of a water-soluble indole compound which is now generally thought to be baeocystin. My own analyses of mycelia and 19 fruiting bodies from the Heringsdorf location indicated levels of

psilocybin that are fully compatible with the data from the United States:

TABLE 4

Ingredients Found in Mycelia and Fruiting Bodies of *Panaeolus subbalteatus* (% of Dried Material)

Ingredient	Mycelia	Fruiting Bodies
Psilocybin	0.07	0.08(stem)-0.70
Psilocin	0.00	0.00
Baeocystin	0.00	0.05(stem)-0.46
Serotonin	0.10	0.08-0.30
Urea	0.00	1.80-2.30(cap)

Table 4 shows that the nature and relative amounts of the substances found are different in the fruiting bodies compared to the base mycelium, which was tested here for the first time.

As far as active ingredients are concerned, levels of urea are trivial. The substance does, however, have some significance in terms of chemo-taxonomy. Among species discussed here, urea is present only in *Panaeolus* and *Pluteus* species. Urea was detected "incidentally" during thin-layer chromatography testing intended to discover the presence of indole compounds. Stijve has collected and tested samples of *Panaeolus foenisecii* from eight countries across three continents (namely, America, Europe and Australia), but has consistently failed to find psilocybin in addition to 5-substituted indole compounds. My own analyses of 100 mushrooms from a wide variety of locations across Germany also failed to confirm the presence of this alkaloid and its derivatives. While the local European species that are discussed here also tend to occur on other continents *(Panaeolus subbalteatus,* for example, grows in Hawaii), there are tropical varieties of this genus which are highly psychoactive as well. Given the best possible climate conditions, these species may fruit adventively in Europe for short periods of time.

Panaeolus cyanescens is the most well-known representative of these species (see Figure 29). Like other tropical *Panaeolus* and *Psilocybe* species, *Panaeolus cyanescens* exhibits a strong blue staining reaction. The large number of existing synonyms for the species, as presented by Gerhardt (see Figure 31), again indicates substantial taxonomic confusion, as well as insufficient communication and exchange of information.

Panaeolus Experiences

Sometimes it is difficult to avoid the conclusion that many prominent mycologists are only too willing to disregard existing research results in order to attach their names to definitions of "new" species. Singer lists *Panaeolus cyanescens* separate from *Panaeolus* as belonging to the genus *Copelandia,* along with other species. Nowadays, this classification is becoming increasingly unpopular among mycologists, and many of them do not accept it. *Panaeolus cyanescens is* responsible for a number of remarkable intoxications which occurred on August 19, 1965 in Menton, located on the French Mediterranean Coast. The mushroom spontaneously appeared on compost which consisted of straw and decayed horse dung. The compost was intended to improve lawn quality. It should be noted that the horse dung came from a race track used by horses from tropical countries. Under these circum-stances, it is quite likely that the species responsible for the intoxications was imported to the location from another country. On one occasion, in the early 1970s, *Panaeolus cyanescens* was found at the Budapest Fairgrounds next to the pavilions from Thailand and Vietnam!

About the course of the intoxications: A *woman and her two children ate a meal consisting of only about 60 g (2.1 ozs.) of the mushrooms. Within less than fifteen minutes after ingestion, she began to feel weak, followed by visual disturbances and marked dilation of the pupils. About one hour after the meal she developed dizzy spells that came and went in waves. Increasingly, all colors in her immediate surroundings coalesced into shades of green. The hallucinations were fearsome; the heads of monsters became visible and a wall opened up into an abyss. There was a succession of human figure with animal heads. The next day, everything was back to normal. The oldest child (age 14) also saw her parents' hair color turn green, had dilated pupils and watched geometric shapes appear on the wall. The youngest child*

(age 11) experienced cramps and lost consciousness.

In 1960, Singer and Guzman suggested that *Panaeolus cyanescens* might contain psilocybin, because of the intense blue staining they had observed. It wasn't until after the intoxications in Menton had been publicized, that a research team working with A. Hofmann detected 0.2% of psilocybin in the mushrooms. Considering the powerful effects, however, this concentration appears to be too low to cause such impressive reactions. Later on, Sandoz Laboratories reported the level of psilocybin in dried samples as 0.8%, along with 1.2% psilocin. The level of psilocin, however, may have been falsely elevated by the presence of serotonin and its derivates in the mushroom sample that was being tested.

According to Stijve, a mushroom sample collected by J.W. Allen in Thailand contained 0.4% - 1.05% of psilocin, with only trace amounts of psilocybin; serotonin was present in large amounts, comparable to concentrations found in all *Panaeolus* species.

Apparently, *Panaeolus cyanescens* produces more psilocin than psilocybin. Still, I was able to detect 0.4% of psilocybin in mycelia cultivated on malt agar, with no other indole compounds present.

Discussion of the *Panaeolus* species would remain incomplete without pointing out that those subjectively terrifying psychoses reported in 1965 cannot be attributed to a specific mushroom ingredient, but were likely precipitated by the circumstances (set and setting) surrounding the incident. The effects described by J. Allen in Hawaii after eating 20 specimens paint a different picture altogether:

With radio music playing softly in the dark, euphoria began to come on in waves. After 20 minutes, visions became so intense that I tried to close my eyes. Whenever 1 did close my eyes, my eyelids felt as if they were being sprayed from the outside. Colors were sharp and clear, but I always quickly opened my eyes again. Colors were dancing like laser beams to the rhythm of the music. The stars in the sky assembled in clusters that reached all the way into my soul. I was a little scared at the idea that the ocean water might rush up all the way into our hut. Other than that, feelings of euphoria were overwhelming. At times, I was overcome by fits of laughter. That night, I slept like "a prince ". The following morning I gathered up my belongings and had to walk back across the pasture where I had collected the mushrooms the day before. I noticed a lot of new mushrooms that had grown during the previous night's rainfall. By way of a lingering after effect I felt that the mushrooms were sending me a message: "Don't forget us, come back, if you can ".

It is important to keep in mind that more comprehensive studies on taxonomy and biochemical composition are needed in order to fully understand the *Panaeolus* species. Perhaps A. Weil's suggestion that *Panaeolus subbalteatus* from America's Pacific Northwest induces comparatively stronger somatic effects than the *Psilocybe* species can be investigated chemically as well as toxicologically, in order to reject or support this hypothesis.

1. Panaeolus cyanescens (Bk. & Br.) Sacc. – Syll. Fung. 5: 1123 (1887)

Bas.: *Agaricus cyanescens* Bk. & Br. – Journ. Linn. Soc. 11: 557 (1871)
Deutsche Namen: Blauender Düngerling, Falterdüngerling.
Synonyme:
Copelandia papilionacea (Bull.) Bres., non Fr. – Hedwigia 53: 51 (1913)
Campanularius anomalus Murr. – Mycologia 10: 32 (1918)
Panaeolus anomalus (Murr.) Sacc. & Trott. – Syll. Fung. 23: 323 (1925)
Campanularius westii Murr. – Lloydia 5: 154 (1942)
Panaeolus westii (Murr.) – Lloydia 5: 157 (1942)
Copelandia westii (Murr.) Sing. – Mycologia 36: 552 (1944)
Copelandia cyanescens (Bk. & Br.) Sing. – Lilloa 22: 473 (1951)
Copelandia cyanescens (Bk. & Br.) Boedijn – Sydowia 5: 222 (1951)
Dieser mittelgroße Düngerling ist durch sein blauendes Fleisch und die an den Lamellenflächen vorkommenden dickwandigen Zystiden (Metuloiden) gut gekennzeichnet. Die ziemlich breiten, glatten, deutlich abgeflachten Sporen tragen einen breiten Keimporus. Maße: 11–14(15) x 8–11 x 6,5–8 µm. Der 1–4 cm breite Hut ist weder hygrophan noch schmierig. Die Farben sind, wie bei allen Düngerlingen, sehr veränderlich und variieren von dunkelbraun bis hin zu hellgrau. Ein Velum ist nicht vorhanden.

Figure 31 - Synonyms for ***Panaeolus cyanescens***(according to Gerhardt).

CHAPTER 3.4

INOCYBE AERUGINASCENS: FAST-SPREADING NEW ARRIVALS

On June 15, 1965, 1. Ferencz discovered fruiting bodies known as "fibrehead mushrooms" in Osca, Hungary, county of Pest. The mushrooms' characteristics did not match those of any known species of the genus *Inocybe,* as described in the literature. That same year, as well as on several occasions later on, Ferencz and other mycologists found large numbers of mushrooms of the same species growing in different locations. Eventually, in 1968, these mushrooms were described as a new species named *Inocybe aeruginascens Babos* (see Figure 33, p. 47).

Strange Distribution Patterns in Hungary and Germany

In 1985, a few mycologists who specialized in the study of the genus *Inocybe* found fibreheads with greenish discolorations in 17 locations (46 specimens) across Hungary. In her 1983 article, Babos noted that *Inocybe aeruginascens* had become the most common mushroom of the Lower Valley's sandy areas around the Hungarian capital city of Budapest. The species is known to fruit across these areas, singly or in gregarious clusters on the sandy soil of the poplar forests, or in mixed forests that include poplars. They have also been found on meadows near poplar trees. The mushrooms are loyal to the location and grow there every year, climate conditions permitting.

In 1975, Kaspar collected the *Inocybe* species in Berlin (K6penick District) as well. More detailed studies revealed that the mushrooms had previously been misidentified. As early as 1965, fruiting bodies of the species were found in the. arboretum at Berlin (Baumschulenweg District). The species had been noted "in passing" by other mycologists with little interest in the mushrooms. Many species (about 160) of the large European *Inocybe* genus cannot be easily differentiated from each other, and therefore attract little interest from expert mycologists. The species are part of a large group of mushrooms that are nicknamed "LBMs" (Little Brown Mushrooms) in the American literature and as such they often entail considerable taxonomic problems. Other examples of mushrooms in this group are the *Panaeolus* species as well as those of the genus *Psilocybe.*

Whenever a "new mushroom" appears spontaneously, the question of its origin has to be addressed. Herink, the Czech mycologist, maintains that he had already discovered the species during the 1930s. He reportedly deposited samples in a herbarium, but the mushrooms have never been clearly identified as *Inocybe aeruginascens* on the basis of biochemical analyses. As fruiting bodies of the *Inocybe aeruginascens* were found simultaneously in Hungary and Germany, the direction of the species' geographical migration could not be determined. It is possible that the species was initially confined to a very small area and only began to attract attention after it had migrated into new habitats. We can only speculate about the possibility of mutations that may have evolved from known species over a relatively short period of time.

Finally, during the 1980s, a few fruiting bodies were collected at locations in Holland (1980) and the Rhone Valley (Wallis Canton) of Switzerland (1984).

In 1983, the species immediately attracted the attention of biochemists and clinicians, after G. Drewitz described mysterious psychotropic intoxications caused by these mushrooms in the city and district of Potsdam, Germany, during June and July, 1980. The observed range of effects was sensational for mushrooms of the *Inocybe* genus, because many of its species induce typical muscarine poisoning symptoms. Muscarine causes parasympathetico-mimetic symptoms, such as pupil contraction (miosis), increased salivation and saliva production. Muscarine has been identified in at least 40 species of the *Inocybe* genus. The first reports

about deaths following ingestion of the potent muscarine-containing *Inocybe patouillardi Bres.* date back to the early 20th century.

Identification Errors

Below is a more detailed description of the effects of *Inocybe aeruginascens:*

On June 30, 1980 a teenager collected the mushrooms near Potsdam and misidentified them as fairy ring mushrooms (Marasmius oreades (Bolt. & Fr.) Fr.), a species known as a choice table mushroom. At home, the teenager's father sauteed the mushrooms in margarine, and they were subsequently eaten by both of them. The son ate only about one-third of the cooked mushrooms.

About 35 to 45 minutes after the meal, both father and son began to experience initial symptoms. The son mainly reported colorful illusions and hallucinations. The woven pattern of his white handkerchief suddenly appeared as shining stripes of crimson red. With his eyes closed, he saw magically illuminated, abstract structures. He noticed his own state of foolish silliness that occurred for apparently no reason at all. Following his father's instructions, he soon found himself outside, in the pouring rain, running back to a near-by railroad embankment, still laughing and giggling, in order to gather more of the mushrooms that had poisoned him.

The father's symptoms initially included yawning and a burning sensation of the face, as well as itching at the hairline and fatigue. He then experienced increasing numbness (paraesthesia) of the left half of his face and his left arm. Later on, these symptoms spread to the right half of his body. Fully conscious, he also noticed motor disturbances that disrupted his language ability. His psyche was increasingly dominated by images of depersonalization: For the duration of the experience he felt that he "was standing beside himself as an observer", while his voice sounded very strange to him.

The second case of intoxication in Potsdam occurred on July 13, 1980:

Seventy-five minutes after ingestion of fibrehead mushrooms with greenish discolorations (Inocybe aeruginascens), the woman began to experience hot flashes, nausea without vomiting, strongly dilated pupils, along with a marked sense of intoxication that she described as "mostly amusing ". Spacial illusions were experienced in combination with striking feelings of weightlessness, distances appeared to be magnified. After several hours, these symptoms gradually faded without lasting consequences; only the dilation of the pupils persisted well into the next day.

Based on these cases, Drewitz proposed that the mushrooms contain psilocybin or similar substances, a hypothesis that was later confirmed (see Tables 6 and 7, p. 49).

More cases of intoxications were reported in the years that followed and earlier cases could also be traced to this mushroom species. In each of these cases, the mushrooms were misidentified as fairy ring mushrooms.

TABLE 5

Accidental Intoxications with *Inocybe aeruginascens* in Eastern Germany

Year	# of People	Location
1977	3	Hohen-Neuendorf
1980	2	Teltow
1980	1	Potsdam
1984	4	Oranienburg
1984	2	Magdeburg
1985	3	Woltersdorf
1986	7	Potsdam

In all cases, the symptoms subsided after several hours, with no lasting side effects. A psychiatrist surely would have found these situations interesting - especially the last case involving an extended family - and would most likely have welcomed the opportunity to study the psychodynamics and social interactions during the period of collective intoxication.

In 1983, Babos reported another case of unintentional ingestion of *Inocybe aeruginascens* in Budapest, which had occurred on July 1, 1970. In this case, symptoms included subjective feelings of decreasing gravity, colorful hallucinations, spacial illusions and nausea without vomiting.

Flights of the Soul

In this context, the following account is of interest; it details the experience of a mycologist who took 2.4 g of dried mushrooms in the course of a test experiment:

The mushrooms tasted like ordinary table mushrooms. While reclining in a state of relaxation about 30 minutes later, a very comfortable feeling of loss of gravity set in, with no other somatic effects. Abstract hallucinations developed slowly, in the form of bursting colors and lights. Once a state of complete loss of gravity was attained, it was followed by a very vivid sensation of the soul in flight, coupled with feelings of euphoria. When looking out the window into the dark night of a forest landscape, visions of strange patterns and formations occurred, which were deeply impressive and seemed to impart an inkling of eternity. At the end of four hours, the effects had dissipated without dysphoria or any type of somatic side effect.

A control experiment for comparison purposes was performed using 0.8 g of dried Psilocybe semilanceata. The onset of symptoms was much more sudden, including a heavy flow of tears, so that there was an initial phase of anxiety. Only in a later phase of the experience was it possible to perceive ornaments in the form of "underwater streamers", and to appreciate the aesthetically enhanced nature of these visions.

The regular pattern of involuntary intoxications is a good indicator for the large scope of expansion of *Inocybe aeruginascens* into new habitats during the 1980s. For example, at the time of the initial intoxications - when the species was still restricted to a few easily quantifiable collections - the mushrooms had spread from Potsdam to the location known in 1982, and from there moved on to several other locations in the vicinity, where more than 150 mushrooms were found (see Figure 34).

Symbiosis With Trees

Starting in late May 1984, fruiting bodies of the species could be found in abundance at countless new locations across the Brandenburg region of Germany. They tend to grow near the roots of different deciduous trees (Populus, *Tilia, Quercus, Betula),* on lawns in parks and gardens, at the edges of trails and in the paved margin areas of tree-lined sidewalks (where they may even grow on bare, sandy soil) as well as amongst the greenery of residential areas in the suburbs and communities in and around Berlin.

Herein lies the most marked difference between *Inocybe aeruginascens* and other European psychotropic mushroom species: *Inocybe aeruginascens* grows only in areas of human development. Their prime locations are in the middle of villages and towns, where they grow locally much like other *Inocybe* species. They may temporarily produce mass quantities of fruiting bodies, in those locations that are typical habitats for the edible varieties of the fairy ring mushroom.

So far, the most abundant crop of fruiting bodies was observed in 1987, due to very wet weather conditions, which allowed the mushrooms to thrive. The following years were comparatively dry and the species hardly fruited at all. It wasn't until 1990 that a few mushrooms re-emerged at the classic location in Potsdam. Despite 1989 having been a bad year for mushrooms, it was the year when *Inocybe aeruginascens* was found for the first time at four locations in and around Rostock, a city located on the Eastern German coast, which is famous for its wet climate. Finding the mushrooms at these locations is evidence for a much wider expansion of the species. In coming years, we should expect the species to further migrate into areas with sandy soil.

The *Inocybe* species are mycorrhizal mushrooms, that is, in contrast to other psilocybin-containing species, they require a symbiosis with certain types of wood in order to fruit. Fruiting occurs at the time of greatest biochemical activity of the symbiotic partner trees. Following periods of extended rainfall, *Inocybe aeruginascens* grows in the trees' root areas from late May until October. The mushrooms are especially common in May and June, a time period during which *Inocybe aeruginascens is* easily differentiated from other species of fibreheads, as long as one pays close attention to locations, the characteristic greenish to bluish discoloration (e.g. if the mushrooms are stored overnight, especially in the refrigerator) and the description shown below (see Figure 32).

Beschreibung

Hut: 2—3 cm, trocken, mittelbräunlich, nach dem Rand zu radialfaserig, im Jugendstadium stumpfkegelig, dann ausgebreitet, in der Mitte gebuckelt, spitz zulaufend, Rand nicht selten etwas eingebogen, Farbe des Buckels etwas dunkler, mitunter etwas oliv- bis blaugrünlich gefärbt.

Lamellen: zuerst im Jugendstadium hell, später ton-, oliv- bis tabakbraun, normal dichtstehend.

Stiel: 3—4,5 cm, 2—5 mm Durchmesser, zur Spitze hin etwas verbreitet, seidig gestreift, nur an der Spitze bereift, Basis knollig, jung weißlich, am Standort bald, vom Stielgrund her, bis etwa zum Mittelteil außen mehr oder weniger deutlich blaugrün verfärbend, nach dem Längsschnitt durch den Fruchtkörper verfärbt sich auch das Fleisch in diesem Bereich ebenfalls blaugrün.

Sporen: 7 - 9 (12), 4,5 - 5,5 µg, glattwandig, etwas elliptisch.

Zystiden: 46—60, 21—25 µm, auffällig dickwandig und dickbauchig mit Kristallschopf.

Description

Cap: 2-3 cm broad, dry, medium brown, radially striated at the margin; cap is obutsely conic when young, widening later on, with an acutely umbonate protrusion at the center; margins are usually somewhat incurved and the color of the umbo is somewhat darker, occasionally olive to bluish green.

Gills: light-colored at first when young, later on olive to tobacco-brown or clay-colored; gill spacing is crowded.

Stem: 3-4.5 cm long by 2-5 mm thick, somewhat wider toward the top; has velvety stripes and is bulbous at the base; when young, stems are whitish in color; when left at location, the outsides of the stems soon display a pattern of more or less distinctly bluish-green discoloration, starting at the base and progressing halfway up the stem; when fruiting bodies are cut lengthwise, flesh in the exposed areas will also turn bluish-green.

Spores: 7-9(12) by 4.5-5.5 µ, surface smooth, somewhat elliptical.

Cystidia: 46-60 by 21-25 µ, walls remarkably thick and bulky with crystals.

Figure 32 - Description of ***Inocybe aeruginascens*** (Germany, 1986) with English translation at right.

FRAGMENTA BOTANICA
MUSEI HISTORICO-NATURALIS HUNGARICI
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Eine neue Inocybe-Art in Ungarn
Inocybe aeruginascens n. sp.

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In der Umgebung von Budapest ist in den letzten Jahren in den angelegten Pappelwäldern des Tieflandes, auf Sandboden, in den mit Pappeln untermischten angelegten Eichenwäldern und in den natürlichen Wacholder-Pappel-Gesellschaften recht häufig - was besonders aus den von I. FERENCZ gesammelten Exemplaren hervorgeht - eine interessante Inocybe-Art vorgekommen, die sich mit keiner aus der Literatur bekannten Art identifizieren lässt.

Typisch für sie ist das Grünwerden ihres ursprünglich weisslich-cremefarbenen Stiels. Oft ist dieser mattgrün bzw. wird es erst auf Druck; andere Exemplare sind dagegen bereits an ihren Standorten von auffallendem Oliv- bis Blaugrün. Der Hut der Inocybe ist keglig, gebuckelt, ockergelb-rostfarben-orange-rostbraun, zumeist lebhaft und weist in der Mitte auch eine oliv-blaugrünliche Tönung auf. Seine Oberfläche ist - besonders gegen den Rand - radialfaserig oder faserig-rissig.

Figure 33 - First description of ***Inocybe aeruginascens*** in the mycological literature (M. Babos, 1968).

Figure 34 - *Inocybe aeruginascens* fruiting bodies from Potsdam, Eastern Germany.

Unlike species of thin-fleshed *Psilocybe* mushrooms that do not fruit until fall, *Inocybe aeruginascens* frequently suffers from fly larvae infestations, especially in older colonies. The resulting lesions are injured areas that turn greenish-blue. It must be noted, however, that of all species introduced here, *Inocybe aeruginascens is* most easily misidentified by laypersons, as it is of the same genus as the potentially lethal species that produce muscarine.

Drewitz's speculation that *Inocybe aeruginascens* contains psilocybin was supported by results from my own investigations in 1984. Extracts of more than 100 mushrooms collected in Hungary and Germany from 1967 to 1990 were examined. Quantitative analyses revealed that the fruiting bodies contained a fairly constant amount of psilocybin each, as well as some baeocystin. These results were first reported in February, 1985. Later that year, the presence of psilocybin in *Inocybe aeruginascens* was confirmed by research teams from the former West Berlin, Regensburg (Germany) and Switzerland. Known cases of intoxication seemed to indicate that the fruiting bodies contained small amounts of muscarine. But among all the samples that were tested - at all stages of development and from widely different collections - not one specimen contained even trace amounts of muscarine.

In collaboration with colleagues from Czechoslovakia, we were able to confirm that the average alkaloid content does not vary much, a finding based on analyses of extracts from several mushrooms. Moreover, the alkaloid content of fruiting bodies stored for prolonged periods declined only slightly over time:

TABLE 6

Psilocybin Content of *Inocybe aeruginascens* from Various Locations (% of Dried Samples)

Location	Year Found	Year Analyzed	Psilocybin
Potsda	1984	1984	0.38
Potsda	1983	1984	0.34
Potsda	1982	1984	0.33
Berlin	1975	1985	0.11
Hungar	1967	1985	0.22

Psilocybin levels in *Inocybe aeruginascens* are comparable to those found in *Psilocybe mexicana Heim.* Moreover, *Inocybe aeruginascens* contain traces amounts of psilocin at most. Baeocystin, on the other hand, is accumulated at levels comparable to those of psilocybin. The alkaloid content of the *Inocybe* species differs from those found in the *Psilocybe* species, which contain three to five times more psilocybin than baeocystin. The variation of alkaloid content across different samples of fruiting bodies is illustrated in Table 7, which shows the results from analyses of mushrooms collected at a location in Caputh near Potsdam on June 8, 1986 (see Figures 32 and 34).

TABLE 7

Psilocybin and Baeocystin Content in Single *Inocybe aeruginascens* Fruiting Bodies (% of Dry Weight)

Mushroom	Dry Weight (mg)	Psilocybin	Baeocystin
1	0.110	0.43	0.15
2	0.118	0.26	0.24
3	0.220	0.23	0.22
4	0.221	0.50	0.25
5	0.298	0.16	0.20

In addition, it should be noted that results from these analyses of mushroom extracts indicated the presence of a previously unknown alkaloid, which I have named *aeruginascin.* The molecular structure of this substance must be similar to those of psilocybin and baeocystin. It is a compound that is soluble only in polar solvents, such as water, methanol and acetic acid. The levels of concentration of aeruginascin found in the fruiting bodies is comparable to those of the other two alkaloids. The compound is characteristic of the *Inocybe* species, so that the analytical results of mushrooms extracts using thin-layer chromatography constitute a kind of fingerprint identification of *Inocybe aeruginascens.*

Of course, there is the question whether this substance contributes to the psychoactive effects of *Inocybe aeruginascens.* It is remarkable that all cases of involuntary intoxication

induced a feeling of euphoria, despite a psychological state of mind likely to create extremely unfavorable internal conditions ("set") for having a "positive experience" (i.e. knowledge of being poisoned by mushrooms with unknown and potentially fatal consequences). In addition, these cases of intoxications happened in the course of pursuing normal, everyday activities, including appointments and other interferences ("setting") which should have precipitated a much more negative type of experience. Future research must focus first on the discovery of the molecular structure of aeruginascin, as well as its synthesis. Subsequent studies should investigate the potentially moodaltering influence of this substance in terms of the mushroom's psychoactive effects as a whole. Moreover, we cannot exclude the possibility that ingestion of the mushrooms may cause a slow release of alkaloids from the organic matrix, followed by their gradual resorption, a process suggested by the effects of the mycologist's test experiment described above. In the meantime, the presence of psilocybin along with baeocystin has also been confirmed in the following *Inocybe* species:

Inocybe corydalina Quel.
Inocybe haemacta Berk. & Br.
Inocybe tricolor Kuhner
Inocybe coelestium Kuyper

These species, however, are not significant contributors in terms of involuntary intoxications, because, for the most part, these *Inocybe* species are extremely rare and grow almost exclusively in forests. Also, their psilocybin levels were lower than those found in *Inocybe aeruginascens.*

Among these species, *Inocybe corydalina* is the most common. An analysis revealed a psilocybin content of only 0.011% - 0.1%, a concentration so low, that this species would become clinically relevant only if large amounts of the mushrooms were eaten.

As part of my own experiments, I also detected psilocybin in *Inocybe calamistrata (Fr.:Fr.) Gill,* a species whose lower stem area is blue. Other authors have not succeeded at confirming the presence of psilocybin in this species.

CHAPTER 3.5

GYMNOPILUS PURPURATUS - MAGNIFICENT MUSHROOMS FROM SOUTH AMERICA

Another controversy documented in the literature revolves around the psychoactivity of several species of the genus *Gymnopilus.*

More than 50 years ago, in October 1942, a remarkable case of intoxication occurred m Cleveland, Ohio, which was attributed to *Pholiota spectabilis.* Today, these mushrooms have been identified as *Gymnopilus spectabilis (Fr.)A.H. Smith (USA).* In Europe, they are also Known as *Gymnopilus junonius (Fr.) Orton.*

A woman had been out for a walk in the woods one afternoon and had taken a few nibbles from a mushroom that she found, feeling confident that she could distinguish the edible from the poisonous ones. As soon as she lay down, she began to experience the most glorious visions *of color and sounds of music, but with no feelings of discomfort whatsoever. A friend who was with her felt that a doctor should be called immediately. When she consulted me about her symptoms, I told her that certain mushrooms are known to cause the symptoms she suffered. I added that these mushrooms were not classified as poisonous, nor did the effects last very long.*

called that same evening and said that the hallucinations had soon passed and that she was feeling perfectly normal again. She added that if this was the way one was supposed to die of mushroom poisoning, she was all for it.

Another case of poisoning was chronicled in Harvard, Massachusetts:

On September 9, 1966, at about 9 a.m., a 56~year-old retired mechanical engineer of Harvard, Massachusetts, picked a bunch of mushrooms clustered by the side of the road in front of his house. Under the mistaken impression that they were honey mushrooms (Armillaria mellea an edible species) he tasted the fresh flesh and found them to be slightly bitter However, he took them home, where his wife washed them and fried them in butter. He ate *two or three caps around noon and within 15 minutes began to feel disconnected and "woozy" . head felt numb and his vision was blurred.*

The room seemed smaller, and the walls closer than usual. Objects were shimmering, and appeared yellow with dark areas in the center. The trees and grass were a vivid green, with spots of radiant purple. These sensations were not unpleasant. Everything seemed to be unnaturally colored, resembling the image of a color TV. Even though he was unable to collect his thoughts, his mind felt sharp and clear: he asked himself questions and immediately knew the answers. By contrast, after having put down a book, he was unable to find it again. After a few hours all three of the involuntary participants had recovered and were able to give a coherent account of their experience.

In this case, the mushrooms involved were also identified as *Pholiota spectabilis. This* identification is questionable, however, because the species is generally described as having an extremely bitter taste. It was determined that there are significantly more species of the genus *Gymnopilus* in North America (73) than there are in Europe (15).

Mushrooms 24 Inches Tall!

Even though *Gymnopilus junionius is* one of the largest-sized species of mushrooms (with stems that have been observed to grow up to 24 inches [60 cm] tall), there are no known European cases of intoxications caused by *Gymnopilus* species. The extremely bitter taste typical of some *Gymnopilus* species is an effective deterrent to their ingestion as table mushrooms, anyway.

However, the cases of intoxication in the U.S. prompted Hatfield and his collaborators to perform phytochemical testing on some of these species. From 1968 to 1971 this group of investigators reported that eight species, including *Gymnopilus junonius* contained inactive styrylpyrones, such as bis-noryangonin. In the wake of yet another case of unintentional

intoxication with *Gymnopilus validipes* in the U.S., the same research team was able to confirm that this species contained psilocybin (0.12%). They also found the alkaloid in three other species, including *Gymnopilus spectabilis*.

Still, similar analyses of European *Gymnopilus* species continued to yield negative results.

It was only through a set of strange circumstances that the presence of psilocybin and its derivatives was finally confirmed in European mushroom species of the genus *Gymnopilus*.

As far back as May 1887, a new species of mushroom was found growing on a tree fern trunk in the botanical gardens at Kew, England (also see p. 30, bottom right). The discovery eventually led to the publication of these mushrooms as a new species named *Flammula purpurata Cooke & Massee.* In this context, we must credit Mordecai Cooke (1825-1914), a mycologist of outstanding competence and expertise, who studied a vast number of mushrooms species, including *Psilocybe semilanceata.* He was the first to formulate a hypothesis about the nature of the bluing phenomenon and to point out its physiological significance (also see p. 16, bottom right). He discovered *Inocybe haemacta* as well as several *Panaeolus* species and classified the *Flammula* species mentioned above. Remarkably, one of his first publications was a book of popular folk tales entitled *"The Seven Sisters of Sleep"* (1860), which just happened to be an interdisciplinary investigation of narcotic plants. Did he himself, perhaps, sample one of the psychotropic mushroom species? Most likely, we will never know the answer to this question. Eventually, the *Flammula* species came to be recognized as being native to Australia and South America (Chile), where the mushrooms fruit on dead tree trunks during the month of May. Later on the mushroom's name was changed to *Gymnopilus purpuratus (Cooke & Massee) Sing.*

Mushrooms on Compost Mixture of Wood Chips and Pig Manure

In 1983, a conspicuous mushroom was observed growing on discarded bark and wood chips near a particle board factory in RibnitzDamgarten on the Eastern German seaboard. The mushroom was initially classified as *Tricholomopsis rutilans (Schaeff.:Fr.) Sing.* However, this magnificent and beautiful mushroom was found to have spore dust colored orange to rusty brown, along with a well-formed, bright yellow cortina. It also turned blue in reaction to pressure and with age. Closer study revealed that the specimen was actually of the species *Gymnopilus purpuratus,* a mushroom that, after a hundred years, had once again been imported into Europe. The microclimate essential for the mushroom's growth had been created by mixing liquid pig manure with the discarded wood chips. A powerful composting process results from pouring the liquid manure onto heaps that are up to 20 yards long and several yards tall. The process is designed to eliminate both types of refuse. Measurements inside the heaps revealed temperatures of about 176° Fahrenheit. Consequently, the Gymnopilus species were able to thrive on the top layers of the heaps, along with other species from Asian and South American countries with warm climates.

There is, of course, the question of just how the *Gymnopilus* species got to Europe in the first place. In the late 1970s, large amounts of feed grain were imported from Argentina. Thus, it appears likely that some mushroom spores may have stuck to the grain from where they passed unharmed through the pigs' digestive systems and went on to colonize the compost heaps.

Even though the compost heaps are plowed at least twice a year and shipped as fertilizer to surrounding fields after about two years of storage, the mushrooms continue to grow on wood piles in new locations whenever its spores have reproduced (see Figure 30, p. 40). However, in the wake of changes in economic conditions and growing ecological awareness in Eastern Germany, it is likely that this composting process will soon be discontinued so that this mushroom species may disappear in Europe once again.

The following description characterizes the *Gymnopilus* species that does not have a bitter taste:

Cap: 15-42 mm broad, occasionally larger sizes up to 20 cm in diameter. Flesh thin, broadly convex without an umbo. Evenly covered with pointy scales, purplish to ruby on yellow background, dry. Margin inrolled at first,

incurved later, occasional blue stains.

Gills: Close, golden yellow at first, rusty yellow later on due to maturation of spores, edges concolorous with lamellae and bald.

Stem: Not hollow, 6-10 mm x 30-80 mm, very rarely up to 15 cm tall, cylindrical to slightly club-shaped, coarse fibrils, striated, lower stem area and base bruise grayish-blue to Greenish when injured and with age, found alone or in clusters of up to 22 mushrooms.

Cortina: Sulphur yellow, almost appendiculate along margin, fibrous at the apex without forming a true annulus, disappears with age.

Basidia: Approximately 35 u long, club

By 1969, Singer had noted that based on analyses performed by Cassels in Chile, the mushroom contained an indole derivative and that the species may be hallucinogenic because of the bluing reaction. By 1988, reports from Germany also confirmed the presence of psilocybin in mushroom extracts of the same species, as evidenced by the results of thin-layer chromatography testing (qualitative detection only). That same year, my own quantitative analyses of 26 mushrooms also revealed that psilocin and baeocystin were present in all fruiting bodies of the *Gymnopilus* species. So far, no other European species has been found to contain as much psilocin as *Gymnopilus purpuratus:*

TABLE 8

Alkaloid Content in Two Collections of *Gymnopilus purpuratus (%* of Dry Weight).

Mushroom	Psilocybin	Psilocin	Baeocystin
Sample Collected in 1988			
1	0.29	0.28	0.05
2	0.31	0.29	0.04
Sample Collected in 1987			
1	0.32	0.03	0.03
2	0.21	0.02	0.02

Table 8 illustrates the unstable nature of the psilocin molecule: during the one-year storage time until analysis in 1988, much of the sample's psilocin had already decayed.

Alkaloid concentrations were found to be higher in smaller mushrooms, as shown in Table 8. Larger mushrooms contained about 0.1 % of both psilocin and psilocybin. I am not aware of any cases of accidental intoxication nor any self experiments involving *Gymnopilus purpuratus.*

Intoxicating Potions of the Yurimagua Indians

In light of the discovery of psilocybin as an active ingredient in a South American *Gymnopilus* species, numerous historic accounts also appear in a different light.

Jesuits of the 17th and early 18th centuries who had travelled to the western Amazon (Peru) reported that the Yurimagua Indians habitually prepared a potently intoxicating potion derived from a tree-dwelling mushroom. The mushrooms appeared on fallen trees as a kind of reddish growth with a spicy taste. The potion was said to be so potent that nobody who swallowed three mouthfuls of the brew was able to resist its effects. The mushroom was considered to be *Psilocybe yungensis Singer & Smith.* However, since *Gymnopilus* species are reddish in color (see description of *Gymnopilus purpuratus,* above) and tend to colonize dense tree trunks, those strange tree-dwelling mushrooms were most likely a *Gymnopilus* species. The *Psilocybe* species, after all, grow almost exclusively on wood sprigs and tree bark debris. On only one exceptional occasion did we discover a specimen of *Psilocybe bohemica* growing on a thoroughly rotted, wet tree trunk (see p. 31, top right). Most likely, the reddishcolored tree-dwelling species was closely related to *Gymnopilus purpuratus.* The discovery of psilocybin in a mushroom of the *Gymnopilus* species marked the first time this substance had ever been found in a member of the family *Cortinariaceae.*

The *Inocybe* species who were found to contain psilocybin later on, are also members of this family. Since the alkaloid had previously been found in *Psilocybe, Panaeolus* and *Conocybe* species - which are not closely related

to each other - the hypothesis postulating psilocybin's significance as an important chemo-taxonomical substance had to be abandoned.

Future research should attempt to verify the presence of psilocybin and its derivatives in other tropical and subtropical Gymnopilus species. Taxonomically, the genus has not yet been exhaustively studied, and mushroom lovers may want to watch out for occurrences of Gymnopilus purpuratus in certain European locations, such as botanical gardens or herbariums.

CHAPTER 3.6

CONOCYBE CYANOPUS - TINY MUSHROOMS OF REMARKABLE POTENCY

While studying the magic mushrooms of Mexico during the 1950s, R. Heim described a new species of the genus *Conocybe.*

Conocybe siligineodes Heim was reported to grow up to 8 cm (3.25 in.) tall, a beautiful, reddish brown to orange-colored mushroom that thrived on rotten wood and which was used as a psychotropic species by the Indians as well. However, the species did not appear again in the literature, nor were the chemical composition or the effects of these samples published. Even after decades of field research in Mexico, Guzman was unable to find the species there. Similarly, he did not discover native usage of any kind of *Conocybe* species. Heim's description however, aroused curiosity as to the chemical composition of this species. Approximately 55 European species which existed saprophytically were relegated to a shadow existence in the older literature. Also, the differentiation of these species is very problematic at times. For the most part, the mushrooms are small and fragile, decay quickly and grow mostly in grassy and mossy areas, where they are easily overlooked.

Around 1930, J. Schaffer discovered numerous *Conocybe* species growing in abundance on a fertilized grassy area near Potsdam. Intrigued by the mushrooms' extra-ordinary variety of forms and colors, he was inspired to undertake the kind of taxonomic classification that is essential to pursuing mushroom research. One species that he found in Potsdam, Berlin as well as in Germany's Harz Mountains showed bluish discolorations at the base of their stems. This "Galera" species was included by Kuhner as *Conocybe cyanopoda* in his 1935 monograph about the genus *Conocybe.* Today, this species is referred to in the literature as *Conocybe cyanopus (Atk.) Kuhn.* This species with a blue base had been previously discovered in the U.S. (Ithaca, NY) in 1918 and was judged by Kuhner to be identical with the European mushrooms.

The following is an adequate description of *Conocybe cyanopus,* because its bluish discoloration is a sufficiently unique attribute to allow differentiation of this species from other European *Conocybe* species.

Cap: 0.3-2.5 cm broad, nearly hemispheric to convex, striated, ocher to dark brown without grey-green stains.

Stem: 2-4 cm long, 1-1.4 cm thick, whitish at first, equal to slightly curved at the base, silvery later on, stains bluish-green - particularly at base - in reaction to injuries or with age.

Spores: 7-10 x 4-5 um

Basidia: 4-spored, pleurocystidia absent, cheilocystidia present, 18-25x6, 5-10 ,um
Habitat: On grassy areas or moss, summer through fall.

The *Conocybe* genus is a member of the *Bolbitiaceae* family, which is similar to the *Coprinaceae,* a family of dark-spored mushrooms that includes the *Panaeolus* species.

The *Conocybe* species are very rare in Europe. The mushrooms are hardly ever found among lists of mushroom discoveries from European countries. Aside from Schaffer's discovery, the mushroom was reportedly found or described only twice (!) within the territory of the former East Germany over the last 60 years (both discoveries were made during the 1980s). However, there are only few mycologists who specialize in the study of the *Conocybe* genus, due to its lack of attractiveness.

Even though the mushroom is very rare, I was able to include one picture of *Conocybe cyanopus* in this book (see Figure 36, p. 57). 1 also had the good fortune to obtain a dried *Conocybe cyanopus* sample for chemical analysis (see Table 9, p. 56).

Psilocybin was discovered for the first time in a sample of fruiting bodies of the species *Conocybe cyanopus* which had been collected on September 4, 1961 in Seattle, WA. No psilocin

however mysterious they may remain.

In 1977, Repke and his research team reported the discovery of baeocystin, as well as psilocybin in a *Conocybe* species from the United States and Canada. Once again, no psilocin was found in these samples. Finally in 1982/83, Norwegian researchers confirmed the existence of trace amounts of psilocin, in addition to 0.330.55% of psilocybin, an alkaloid that was also reportedly discovered in Finnish samples. Finally, Beug and Bigwood reported 0.93% of psilocybin in samples collected in the Northwestern United States. Interestingly, the second sample ever discovered in Eastern Germany was found on July 2, 1989 near Potsdam, where several fruiting bodies of the *Conocybe cyanopus* species were growing in a grassy area on sand. The original area, however, where Schaffer first discovered the species 60 years ago, lay within the Potsdam city limits and its exact location can no longer be determined.

The sample collected in 1989 consisted of five mushrooms that were found to have concentrations of psilocybin and baeocystin similar to levels found in *Psilocybe semilanceata:*

Concentrations of psilocybin were strikingly similar to those found in samples collected in the Northwestern United States.

After several days, spores from one of the fruiting bodies germinated on malt agar and, compared to other species, proceeded to grow very slowly into their permanent forms or "sclerotia" (see Figure 35, p. 57). The sclerotia showed no blue discolorations, and were found to contain 0.25 % psilocybin when dry, while no additional alkaloids were detected.

In summary, it is reasonable to assume that due to its small size and extreme rarity, *Conocybe cyanopus is* a species that is not a significant contributor to intoxications in Europe, nor is it likely to gain such prominence in the future. My own analyses of other, non-bluing *Conocybe* species, such as *Conocybe tenera (Schaeff.:Fr.) Fayod* and *Conocybe lactea (Lge) Metrod* revealed the presence of physiologically inactive ingredients only.

Samples of *Conocybe* species from warm countries have not yet been analyzed and may yet yield remarkable results in terms of chemical composition and alkaloid content.

TABLE 9

Selected Test Results on the Alkaloid Content of ***Conocybe cyanopus*** *(%* of Dry Weight)

Mushroom	Dry Weight(mg)	Psilocybin	Baeocystin
1	5	0.84	0.15
2	6	0.73	0.12
3	7	1.01	0.20
4	10	0.91	0.16
5	12	0.89	0.14

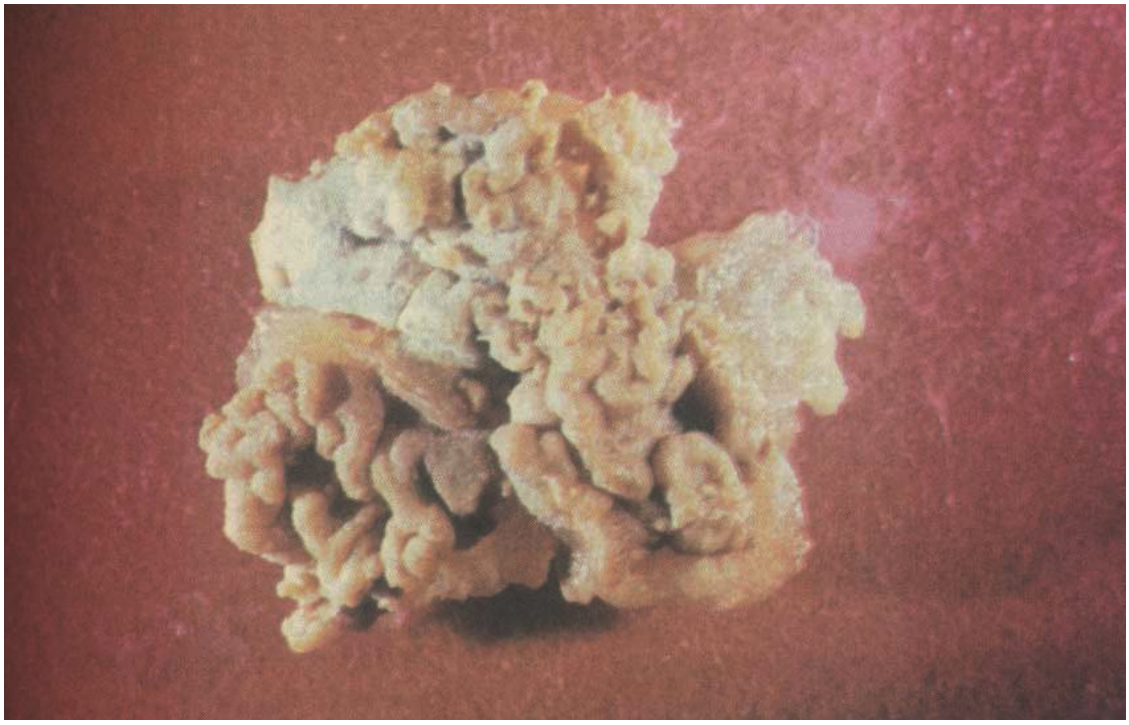


Figure 35 - Sclerotia of *Conocybe cyanopus* grown on malt agar.

Figure 36 - Fresh *Conocybe cyanopus* fruiting bodies from the Pacific Northwest (USA).

CHAPTER 3.7

PLUTEUS SALICINUS: A LITTLE-KNOWN WOOD-INHABITING SPECIES

Within the Pluteaceae family, there are about 45 European species of the genus Pluteus, some of whom also produce psilocybin.

Historically, the Pluteus species were classified as belonging to the Amanitaceae family, which also include the "death cap" and its relatives, as well as the fly agaric mushroom, both of which belong to the genus Amanita. Unlike all the other psychoactive mushrooms mentioned here in this book, the Pluteus species are classified as light-spored mushrooms, because of their rose-colored spore dust.

No accidental intoxications involving Pluteus species have been documented in the literature.

The first description providing qualitative evidence for the presence of psilocybin and psilocin was provided by Saupe in 1981, who examined extracts of Pluteus salicinus (Pers.:Fr.) Kumm. from Illinois. Surprisingly, psilocin turned out to be the alkaloid with the highest levels of concentration in the samples tested. This mushroom species had previously been described in Europe about 200 years ago. Since then, however, it has rarely been mentioned in the literature, and only briefly, if at all (see Figure 37, p. 59).

Some taxonomic methods of classification used earlier can still cause confusion today. For example, Ricken (1915) designated the mushroom as Pluteus petasatus.

By way of expanding the description from 1962 (see Figure 37), Pluteus salicinus is identified by the following characteristics:

Medium-sized mushroom with a more or less intensely bluish to bluish-green coloration. Older mushrooms are sometimes colored olive green.

Caps in some cases up to 8 cm in diameter, lighter colored around the margin, silver grey, hairy and felt-like, even hairier and felt-like towards the middle of the cap, often scaly.

Stems up to 10 cm in length, with spontaneous grey-green or grey-blue discolorations at the base, colors intensify in response to pressure.

There are also mushrooms of this species that are white in color (see Figure 38, p. 60). However, these albino fruiting bodies have stems whose bases show a slight grey-green coloration as well, as do the apex areas of their caps. Pluteus salicinus has been described as being anywhere from "very rare" to "not rare" in the wet deciduous forests of Europe. The species of the genus Pluteus are final wood-destroyers, that is, they grow saprophytically on wood that appears rotten and discolored, because it has decomposed due to the presence of other mushrooms over the course of many years. Pluteus salicinus fruits from May to October on stumps of willows, alder-trees, lime-trees, beech-trees, poplars, maple-trees and possibly on the wooden remnants of other tree species as well, The fact that this mushroom has not been the cause of any intoxications may be explained by its fruiting bodies' occurrence on tree stumps as single mushrooms or in groups of very few mushrooms. Also, compared to other wood-inhabiting mushrooms, Pluteus salicinus is not very attractive in appearance. The mushroom's habitus is well illustrated by Figure 39 (p. 60).

For unknown reasons, Kreisel described all Pluteus species as "non-poisonous" in his 1987 handbook of mushrooms, despite the fact that psilocybin (0.35 % of dried mushrooms) had already been discovered in samples of this species in 1981 (North America) and 1984 (Norway). The alkaloid was also found in mushrooms from Holland, Finland, Sweden and France. The latter tests, however, were limited to very few fruiting bodies in each case.

Whereas Stijve found an average of 0.25 % of psilocybin in dried mushrooms from 20 samples collected in Switzerland from 1984 to 1986, my own analyses of non-bluing (!) mushrooms collected in Thuringen, Germany in 1986 yielded much higher alkaloid concentrations:

TABLE 10

Psilocybin and Urea Content of Pluteus salicinus (% of Dry Weight)

Sample#	Psilocybin		Urea	
	Cap	Stem	Cap	Stem
1	1.38	0.48	2.50	Traces
2	1.57	0.71	2.60	0.00
3	1.57	0.71	2.60	0.00
4	1.22	1.14	1.40	0.00
5	139	0.64	2.40	0.43

Additional analyses of four bluing mushrooms collected in the Dubener marshlands (Eastern Germany) in 1988, confirmed the presence of only about 0.2 - 0.7 % psilocybin in those mushrooms. This sample also contained very small amounts of baeocystin.

These results indicate that the variability m alkaloid content in Pluteus *salicinus* has not yet been sufficiently calibrated. Therefore, more analyses are needed. In contrast to the findings based on studies of mushrooms collected in America, it is certain that the European mushrooms produce only traces of psilocin at most.

Stijve and Bonnard were able to examine original material collected by Saupe in the United States. To their surprise, they discovered that the mushrooms were not identical to those found in Europe. They also did no longer contain any alkaloids. These findings show that mushrooms of the same name from different continents are not necessarily identical.

All other *Pluteus* species tested so far contained urea, a substance that can also been found in the *Panaeolus* species. However, the latter also produce compounds like serotonin, which do not occur in the *Pluteus* species. Hence, the different species are once again identifiable by their unique "fingerprints".

Other rare *Pluteus* species with bluish or violet discolorations are mentioned in the literature, such as a *Pluteus cyanopus* from Europe. However, so far, very small amounts of psilocybin (0.035% of dried mushrooms) have been found only in *Pluteus nigroviridis Babos,* an extremely rare species from Hungary.

Therefore, additional analyses of this fairly neglected genus are urgently needed.

Grauer Dachpilz (Pluteus salicinus). *Grau-rußbraun, Stielbasis etwas ins Blaugrüne.* Hut 3–6 cm, bald abgeflacht-gebuckelt, fein faserig, am Buckel fein schuppig, grau-braun. Lamellen weiß, später lachsfarben. Stiel schlank, weiß, unten etwas braunfaserig mit mehr oder weniger Stich ins Blaugrüne. – Auf Laubholzstümpfen. Recht selten.

Figure 37 - Description of ***Pluteus salicinus*** from 1962 (Germany).
See page 58 for description in English.

Figure 38- *Pluteus salicinus* at a natural location (Germany).

Figure 39- Fresh *Pluteus salicinus* fruiting bodies.

CHAPTER 4

MUSHROOM IDENTIFICATION: TAXONOMIC CONFUSION AND THE POTENTIAL FOR DEADLY MISTAKES

On December 16, 1981, three teenagers hunting for psychoactive mushrooms on Whidbey Island, WA (USA) collected specimens of a Galerina species, in the mistaken belief that the mushrooms belonged to a Psilocybe species. All three of them fell ill after eating the mushrooms, but did not report their symptoms or seek medical help for another two days, afraid of being prosecuted for using psilocybin. After medical treatment, two of the teenagers made a full recovery. The third victim, however, a 16 -year-old girl, died on December 24, 1981.

As presented by Beug and Bigwood, this tragic incident underscores the dangers inherent is careless or erroneous identification of mushroom species, especially when a situation is complicated by overzealous legislative and punitive measures. The psilocybin-producing species as well as culinary mushroom varieties often share some characteristics with many other species. Casual mushroom hunters and lay-persons are especially prone to making identification errors, suffering accidental ittoxications as a result. Previous chapters included several case histories of such involuntary intoxications. To be sure, modern mycological keys are valuable tools when it comes to accuracy in deciding the family and genus of an unknown mushroom sample. It can be extremely difficult, however, to identify the specific species of questionable specimens, especially if the sample belongs to the vast category of "LBM"s, or "little brown mush-rooms". We currently know very little about the "LBM" species, since their habitats and variations in habitus have not been studied in systematic detail. Not surprisingly, reference books are often limited by incomplete descrip-tions that lack the essential criteria for differentiating one species from others that are similar or related. I vividly recall my own first attempts to identify unknown samples by relying on what appeared to be precise definitions in standard mycological reference works. I found many of the listed traits to be descriptive of a wide range of sometimes very different species. As I compared my samples with the text, I noticed a tendency to disregard some of the finer details in the literature, so that "my mushrooms" would better match the descriptions. Naturally, this approach resulted in errors. Luckily, I would quickly discover and correct my mistakes upon consultation with my mycologist friends. In my experience, competence and expertise in the area of mushroom identification are skills honed over time through extensive fieldwork, consultations with established mycological experts, and careful analyses of samples based on information found in appropriate reference books.

The literature clearly indicates that *Psilocybe semilanceata is* one species that, at prime locations, can be easily identified without consulting a diagnostic key. *Psilocybe semilanceata is* known for its uniquely distinctive appearance, so that microscopic tests are not needed to distinguish this species from other pasture-dwelling mushrooms. The situation is different, however, for *Psilocybe* species that thrive on wood debris, as illustrated by the tragic story at the beginning of this chapter. Besides, compared to Europe, the North American mycoflora includes a much broader and varied spectrum of mushroom species to begin with.

Warning: Amatoxins are Lethal!

The *Galerina* genus includes a number of poisonous mushrooms. These species are dangerous, because they contain the same deadly amatoxins as the "death cap" *(Amanita phalloides)* and its relatives, "death angel" and "destroying angel". Their toxins are insidious, with no symptoms evident for about 12 hours. During this latency period, the toxins can cause major irreversible internal damage, which is why many cases are fatal in spite of treatment. A common North American species is *Galerina autumnalis (Peck) Singer & Smith,* which grows on wood debris in parks and forests, just like several of the *Psilocybe* species. At first glance, *Galerina autumnalis* resembles *Psilocybe stuntzii Guzman & Ott,* and the two species may grow

side by side at the same location. The *Galerina* species, however, does not turn blue. I once discovered a grassy area that was home to a cluster of *Psilocybe stuntzii* specimens entangled with a *Galerina* species. The mushrooms had grown so entwined that individual fruiting bodies could be identified only by spore analyses.

Pholiotina filaris (Fr.) Sing. (also known as *Conocybe)* is another North American species known to contain amatoxins. At the same time, these toxins have not been found in European samples of this species. Thus, *Pholiotina filaris (Fr.) Sing.* most likely does not refer to the same species on both continents. Still, at least one European *Galerina* species *(Galerina marginata (Fr.) Kuhn.)* contains the same toxins found in the "death cap" mushroom. This species also grows on decaying wood substrate and its fruiting bodies contain about one-third of the amount of amanitines found in *Amanita phalloides.* Incredibly, older mushroom books list *Galerina marginata* as an edible species.

In a previous chapter on the *Panaeolus* species I illustrated the potential for identification errors associated with commercial cultivation areas that are "invaded" by outside species. Due to their rapid growth, the *Panaeolus* species in particular will often fruit in artificial growing areas long before the cultivated species that is grown there. Chapter 3.3 details the 1970 poisoning incident involving *Panaeolus subbalteatus* from a cultivation area in Leipzig. In that case, the intruding species was mistaken for *Stropharia rugoso-annulata Farlow* (the Giant *Stropharia),* based on information from a mushroom book. Apparently nobody realized the glaring differences between the book's description and the actual characteristics, except for the assumption that the sample's small size meant the mushrooms simply had not grown as tall as portrayed in the book. This flawed conclusion illustrates a type of judgment error common among amateur mushroom hunters who falsely believe that they are experts. Having been shown a single sample of wild mushrooms, for example, some mycophiles become convinced they will always be able to recognize the species in the future. That is how one such mushroom hunter accidently ingested *Inocybe aeruginascens* specimens that he believed to be common fairy ring mushrooms. In a similar case of *Inocybe aeruginascens* intoxication, the mushrooms had been picked as white champignons, even though this common culinary mushroom bears no resemblance, either in size or form, to *Inocybe aeruginascens.* Overall, however, these unfortunate cases have also contributed to our understanding of mushroom biochemistry.

In this context, I want to emphasize once more that the hallucinogenic varieties among the *Inocybes* can easily be mistaken for those muscarine-producing *Inocybe* species that are extremely poisonous.

As part of his investigation of the *Psilocybe* genus, Guzman noted a common trait among the hallucinogenic species, in addition to the bluing reaction: a flour-like smell or taste. Apart from the inherent subjective nature of our sense of smell and taste, a common odor is a trait that definitely does not apply to the European species (also see Chapter 3.2).

Mycophile or Mycophobe?

There are reports from the Western United States about people with expert knowledge of *Psilocybe semilanceata* - devoted mushroom hunters who can identify the species with drill and accuracy. At the same time, however, these experts cannot identify easily spotted common table mushrooms, nor are they able to differentiate the *Agaricus* species (champignons) from other mushrooms, even when these species grow on the same pasture. Such individuals, then, are not interested in species other than *Psilocybe semilanceata.* In my opinion, this attitude reflects a rare combination of mycophilia and mycophobia.

A mushroom's spore dust provides important information needed to determine identity. A spore print is left by the gills when the cap is placed on black or white paper (depending on spore color). As the process takes several hours, a glass vessel must be placed over the cap to prevent drying. While useful, information obtained from spore analyses has its limitations, For instance, spores derived from mushrooms belonging to different genera may have the same color, but reveal basic differences under the microscope. There is also a high degree of similarity among spores from different Psilocybe species. Thus, the only way to prevent grave errors and potentially deadly intoxications is to rely on experienced experts for mushroom identification, a process that must include analysis of available ecological data.

CHAPTER 5

THE BLUING PHENOMENON AND METOL TESTING: REALITY VS. WISHFUL THINKING

As previously discussed in Chapters 3.1 and 3.7, the bluing reaction is characteristic of species that produce psilocybin. Still, for unknown reasons, some species or samples belonging to a genus that usually turns blue may not always change color, regardless of psilocybin content. Among the species that I have examined, *Psilocybe bohemica* displayed the most impressive bluing reaction. The caps of this species stain very quickly in reaction to pressure. Other species, such as *Psilocybe cubensis (Earle)* Sing. have stems that develop very intensely blue stains, while their caps do not exhibit the bluing reaction. By contrast, *Psilocybe semilanceata,* Conocybe cyanopus and *Inocybe aeruginascens* are species whose stems develop only slight stains m reaction to pressure and only after a relatively long time period has elapsed. With respect to time delay and intensity of the bluing reaction, Gymnopilus *purpuratus is* a species that falls in between these two extremes.

A Rich Color Spectrum

The colors range from green to a deep blue. *Psilocybe cubensis is* a species in which the latter color may also take on a blackish-blue hue. 'The mechanisms underlying the color reactions in these mushrooms has not yet been studied. I have already mentioned Cooke's speculation from the early years of the 20th century about the significance of the bluing reaction in *Psilocybe* Smilanceata (see p. 16). In the 1950s, it was Singer and Smith who emphasized that discolorations observed in the psychotropic Psilocybe and *Panaeolus* species must somehow be linked directly or indirectly to the mushrooms' active ingredients. Eventually, in 1958, A. Hofmann and his collaborators reported the successful isolation of these ingredients. They were the first to observe that pure psilocin grows unstable when exposed to oxidizing agents such as air and that solutions of psilocin turn bluish-green in an alkaline range.

These results provided proof that the bluing reaction resulted from a mushroom ingredient's breakdown by oxidation. From 1960 on, Blaschko, Levine and Bocks, as well as Horita and Weber performed in-vitro studies of the biochemical reactions of psilocybin and psilocin. They concurred that only psilocin can be oxidized into a product of bluish-green color. The phosphate group prevents direct oxidation of this alkaloid (see Figure 19, p. 27). However, the typical bluing phenomenon does occur when this protective group is removed by enzymes, such as various phosphatases, which are very common in human as well as in mushroom tissue. I also observed the bluing reaction following removal of the phosphate group from baeocystin. Observations from in-vitro experiments explain why *Psilocybe bohemica* displays a strong bluing reaction, despite the fact that levels of psilocin in this mushroom are low or non-existent: Apparently, the enzymatic removal of the phosphate group from the psilocybin molecule occurs quite quickly. This is how psilocin is formed in reaction to injuries to the fruiting bodies. Immediately afterwards, psilocin continues to break down and disappears completely, while a number of blue-colored substances are created. In addition, some enzymes were discovered which accelerate the breakdown of psilocin. Cytochrome oxidases and laccases are examples of such enzymes. The latter has also been found in the mycelia of *Psilocybe cubensis.* Most likely, the enzymes are also formed in those mushrooms that display bluish discolorations in reaction to metol testing. Trace amounts of Iron" ions accelerate the bluing reaction as well. The structure of the blue-colored compounds has not yet been investigated. Apparently, they are quite unstable and involve a type of chemical bond known as chinones. Many pigments are known to have this basic structure.

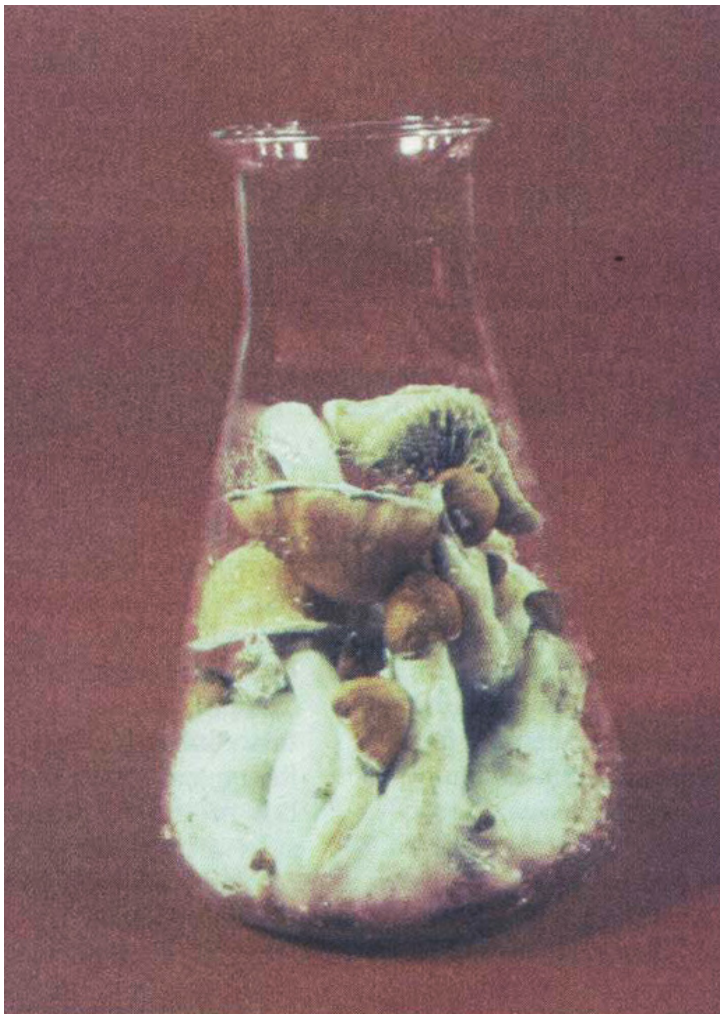


Figure 40 - *Psilocybe cubensis* fruiting bodies whose growth was accelerated with plant hormones.

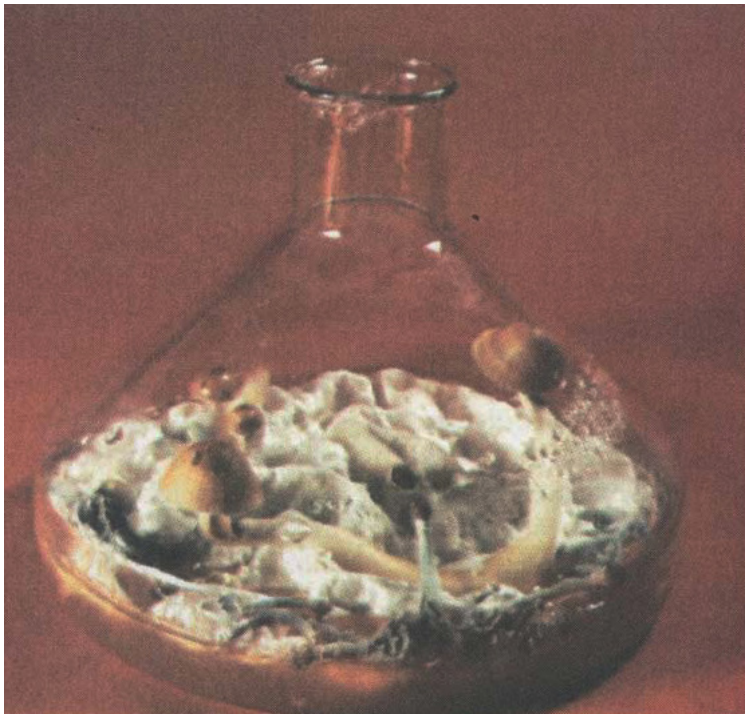


Figure 41 - Mycelial culture of *Psilocybe cubensis* on malt extract (3 % solution).

The Agaricales As Alkaloid Producers

Even though the blue discoloration does not occur in ali mushroom species that produce psilocybin and psilocin, we can say that, conversely, all species of the order *Agaricales* (gilled mushrooms) displaying this reaction are capable of producing alkaloids. Historically, this problem associated with the bluing reaction did not particularly impress early mycologists, because there were a number of boletes which turned blue in reaction to pressure and were thought to be among the most valued culinary mushrooms. Indeed, the mushrooms' color reaction is based on ingredients that are physiologically inactive. The boletes also do not display the kinds of spontaneous discolorations with age that are frequently noted in the psychotropic species.

As results of my own analyses have shown, the alkaloid concentrations in *Psilocybe semilanceata* and *Panaeolus subbalteatus* - whose fruiting bodies showed a slight degree of discoloration at most - are within the same orders of magnitude as those found in mushrooms that do not turn blue. Evidently, the pigments involved have a high degree of intensity; the tiny amounts that were produced did not measurably contribute to the destruction of the active ingredients. On the other hand, my own experiments revealed that levels of psilocin and psilocybin in very old and strongly discolored fruiting bodies and mycelia of *Psilocybe cubensis* were considerably lower in comparison to younger specimens. In 1948, Singer was the first to describe the intensification of the bluing reaction, including a change in color towards violet, in samples of *Psilocybe cubensis* which had been moistened with an aqueous solution of the photographic reagent metol (p-methylaminophenol). Ten years later he reported further examinations of some psychotropic *Psilocybe* species whose stems usually turned purple through contact with this reagent. Since 1970, various "field guides" intended to aid in the identification of North American *Psilocybes* have also described this reaction as specific to the *Psilocybe* species. For practical purposes, however, this guideline is all but useless. The metol merely reacts with the laccase enzyme (several structural types) contained in the mushrooms and it is not a reagent able to confirm the presence of psilocybin and its derivatives. Even the brown and white varieties of the commercial champignon mushroom change colors when exposed to a metol solution, just like many other mushrooms do as well.

The Limitations of Reagents

The discovery and usage of different color reagents as a means to differentiate certain species or even genera has been attempted for quite some time, with only moderate success, for the most part. Melzer's Reagent is a well-known mixture whose usage was propagated as a method for identifying the *Psilocybe* species. For this purpose, however, it turned out to be just as nonspecific and worthless as metol.

G. Drewitz discovered that the application of iron chloride to fruiting bodies of *Inocybe aeruginascens* caused a deep blue discoloration, while the muscarine-producing species of the same genus did not change color. Iron chloride is a salt that reacts with different phenoles to form intensely blue molecules. The underlying mechanism of this reaction is more realistic than the others, because psilocin will also react as a phenole. Independent of this color formation, mere trace amounts of iron ions will suffice to accelerate the oxidation of psilocin by air.

However, *Inocybe aeruginascens is* a species that produces only trace amounts of psilocin; therefore, it is very likely that the iron salt reacts with other phenoles in this mushroom species.

In summary, only those bluing reactions that are spontaneous or caused by injuries provide reliable clues as to the presence of psilocybin and its derivatives in *Agaricales.* The presence of the bluing phenomenon itself, however, reveals nothing about the type and quantity of any specific indole compound that may be present in gilled mushrooms.

CHAPTER 6

MUSHROOM CULTIVATION: CLASSIC FINDINGS AND NEW TECHNIQUES

While conducting research on the Mexican mushroom species during the 1950s, R. Heim and R. Cailleux determined the basic conditions essential to the cultivation of various mushrooms. Before providing additional details, I would like to briefly summarize the nutritional requirements and characteristics of fungal growth, to the extent that these issues are of interest here.

Extraterrestrial or Earthly Organisms?

In terms of cultivation parameters and nutrients, the psychotropic species are no different from table mushrooms and other common gilled mushrooms. For that reason, Oss and Oeric's speculations about extra-terrestrial origins of these species clearly belong into the realm of fables. In addition, psilocybin and psilocin are substances that can be derived from tryptophan by means of discernable reactions; indeed, the amino acid tryptophan in its free form has been found in a large number of mushroom species.

The natural propagation of higher mushrooms is linked to their basidiospores, which are produced on the gills of developing fruiting bodies and which are eventually cast off. Once the spores have been dispersed - by the wind, for example - they will germinate when conditions are favorable (nutrients, temperature, moisture, lack of competing organisms) and finally, they gradually colonize available substrates. Initially, a monokaryotic mycelial thread (i.e. a mycelium with only one nucleus per cell) grows out of the spore and superficially penetrates the nutrient substrate. When two of these hyphae meet, they form a mycelium with two nuclei, or a dikaryotic mycelium ("mycelial network"). Later on, these mycelial strands go on to differentiate into sporeproducing fruiting bodies ("fruiting"). Eventually, their spores disperse and germinate once again.

During most parts of the year, the dikaryotic mycelium grows unnoticed in its natural substrate and remains purely vegetative, that is, it continues to spread and to utilize new nutritional resources without producing mushrooms, provided there is sufficient moisture and temperatures do not drop below freezing. ln its dormant state, the mycelium can weather droughts and the cold temperatures of winter, only to begin to grow anew. Some species have mycelia with thick strands that are visible within the substrate (e.g. the rhizomorphs of Psilocybe *cyanescens),* while other species, such as *Psilocybe semilanceata,* develop comparatively thin strands that are hardly visible at all.

The Secret of "Overnight" Growth

Every mushroom collector knows that there are years of maximum mushroom yields. Other years, mushrooms are scarce and dry periods may pass with no apparent crops of gilled mushrooms or boletes. For the majority of mushroom species, the specific conditions required to reach the fruiting phase have not yet been determined.

The saprophytic species (including the hallucinogenic ones except the *Inocybe* species: mycorrhiza with trees) generally fruit after optimal mycelial growth has been induced by appropriate nutrient substrates, as long as the following environmental conditions are maintained:

1) Decrease of the temperature until time of optimal fruiting.
2) Increase of the humidity to 95-100%.
3) Decrease of carbon dioxide concentration through increased air circulation.
4) Exposure to light may be necessary for fruiting.

The last two items already touch upon the essential requirements for mushroom cultivation, since these conditions are always present in

Nature, but often need to be specially created for mushroom cultivation inside glass containers or enclosed rooms.

It is no coincidence that the saprophytic species almost always fruit during the fall. Plant substrates such as twigs and leaves fall to the ground during this time and they are immediately colonized by available mycelia from mushroom spores as part of the natural cycle. The concurrent drop in temperature and increase in humidity are preconditions for fruiting. The proverbial rapid growth of mushrooms "overnight" is a function of mycelia that have previously massed together into knots, followed by a differentiation process into primordia, with progressive divisions into caps and stems. The whole mushroom is then ready to develop very rapidly, given sufficient moisture and ideal temperatures. Figure 42 illustrates a comparable in-vitro fruiting process that took about a week, with mycelia from *Psilocybe cubensis (Earle)* on an agar substrate.

Cultivating High Yield Strains

Artificial cultivation is an attempt to imitate and optimize the natural conditions essential for mushroom growth, and may even result in the discovery of additional nutrient substrates on which these species cannot grow in Nature. From the outset, this method of cultivation requires a sterile environment, in order to eliminate often fast-growing organisms such as bacteria and molds. For this purpose, laminar flow hoods are used in mycological laboratories. A small sterile space is created inside these containers by installing a filtration system that removes germs from a stream of air. The sterile space is used for the performance of tasks such as isolation of strains, and the production of sterile cultures and spawn for fruiting experiments. Antibiotics such as gentamycin (0.01%) are often added to the nutrient media, especially in the early stages of this process.

Two methods are used to produce sterile cultures of fungal mycelia.

The first method mimicks the mushrooms' natural reproductive process. Spores that fell off or were removed from the gills are suspended in sterile water. With microscopic control procedures in place, the spore solution is germinated on nutrients of various compositions that have been thickened with agar. One commonly used nutrient medium contains 3-6 malt extract along with 1.5% agar. It induces spores from many different species to germinate in a matter of several days. Prior to germination, all substrates are placed in autoclaves and sterilized with steam. The simultaneous germination of a large number of spores will result in the growth of monokaryotic mycelia which spontaneously combine and go on to form dikaryotic mycelia. Alternatively, one can attempt to systematically fuse selected monokaryotic strands in order to develop vigorous strains for cultivation (criteria: rapid growth, high yield). This is a standard technique that is widely used in the cultivation of champignons *(Agaricus bisporus)*.

At the same time, such cross-breeding experiments enable the grower to determine whether mushrooms from different locations belong to the same species. Using this method, I was able to establish that mycelia obtained from *Psilocybe bohemica* and from *Psilocybe cyanescens* (collected in the U.S.) can never be fused together, which means that these two mushrooms are not of the same species.

The second method of cultivation requires cutting a piece of tissue from the inside of young, unopened fruiting bodies, using a disinfected knife in a sterile environment. The piece of tissue is then placed onto nutrient agar medium. In most cases, visible mycelial growth will occur within a few days. This method has the advantage of all mycelia being genetically identical to the mushroom from which they originated, unlike mycelia grown from spore samples. Therefore, this method makes it easy for the grower to reproduce high yield strains of saprophytic species. Some wild strains obtained from various species do not fruit at all when cultivated, or else, they do so very late, with a yield of fruiting bodies that is sparse at best.

Such differences in response to attempted cultivation were also observed by R. Heim with various strains of *Psilocybe mexicana Heim.* As early as 1956, he took spore sprints from a number of fruiting bodies in Mexico. Later on, in Paris, he was able to germinate the spores and isolate mycelial cultures of five different species. In collaboration with R. Cailleux, Heim

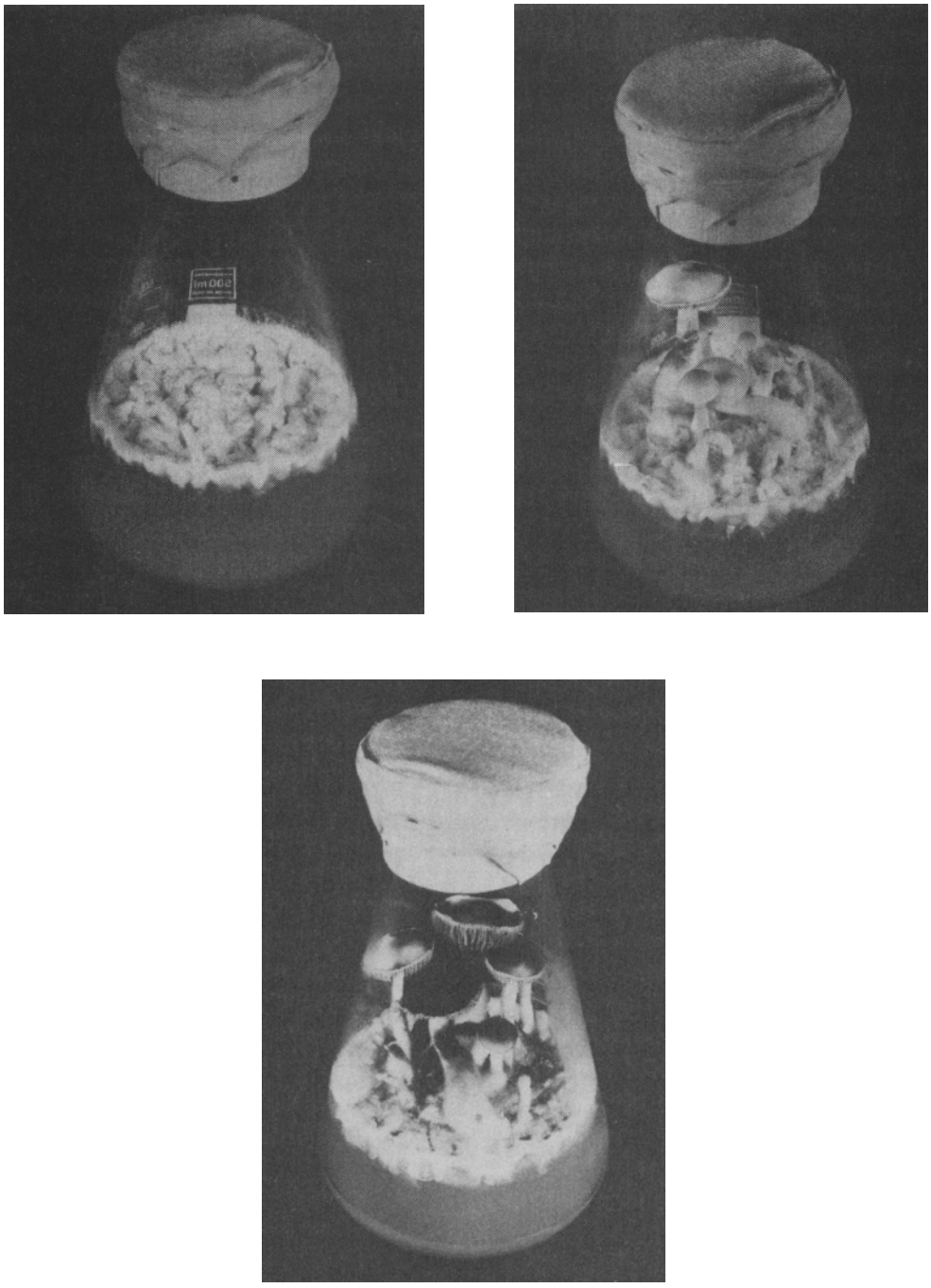


Figure 42 - One-week growth progression of ***Psilocybe cubensis*** cultivated on a malt agar (2%) substrate.

succeeded at growing fruiting bodies of the species *Psilocybe mexicana,* using compost substrate as a medium. This type of substrate is the most widely used nutrient soil for commercial mushroom cultivation (champignons). The fruiting bodies grown by Heim and Cailleux provided the dried material that A. Hofmann and his collaborators used to isolate psilocybin and psilocin for the first time. In Basel, it was also possible to cultivate mycelia from different species on liquid solutions of malt extract. The mycelial tissue was found to produce psilocybin without having to go through the fruiting process. This important discovery became the basis for harvesting large amounts of alkaloids. Unlike the fruiting process, which yielded five harvests over the course of several months, a species' mycelial cultures produced much larger amounts of mushroom tissue in only four weeks (see Figure 41). The cultures were grown on stationary malt extract (4-6%) with 0.2% agar added for increased viscosity.

This kind of saprophytic surface cultivation can be easily adapted for growing species which are difficult to fruit under in-vitro conditions, such as *Psilocybe zapotecorum Heim,* permitting cultivation of these species for alkaloid production. Even though the mycelial tissue grown from the Mexican species contained only half as much psilocybin (0.1-0.2% of dry weight) as the mushrooms did, high yields (approximately 20g/1) along with easy and rapid cultivation of mycelial tissue more than compensated for the lower psilocybin content. It is interesting to note that mycelia from the North American species of *Psilocybe cyanescens will* turn blue and accumulate psilocybin when grown on a medium of solid malt agar, while both of these traits disappear completely when the same strain is cultivated on the type of liquid medium described above, even if levels of nutrients are identical. The reasons for this inconsistency remain a mystery.

When mycelial cultures are kept in the dark, the mycelial forms may become partially permanent (sclerotia). Sclerotia may be hardened, are largely dark to black in color and they contain psilocybin as well. The formation of sclerotia was initially observed as part of the firstever attempt to cultivate psychotropic mushrooms on an agar medium. In 1935, H.J. Brodie reported permanent formations of bluish-green tissue while cultivating *Panaeolus subbalteatus* on malt agar.

Initially, he believed that his nutrient substrates had been contaminated by molds, because *Panaeolus subbalteatus is* a species that almost never spontaneously turns bluish-green. Figure 47 shows a distinct sclerotia formation of the species *Psilocybe semilanceata.* The formation of these permanent structures with *Conocybe cyanopus* has been described in a previous chapter (see Figure 35, p. 57).

Heim and Cailleux primarily described the fruiting of *Psilocybe mexicana* and *Psilocybe cubensis* on agar (0.05-2% malt extract) and on compost. During their experiments, *Psilocybe mexicana* produced the highest yields, while *Psilocybe cubensis* fruited quite vigorously as well. At about the same time, R. Singer had also started mycelial cultures derived from six mushroom species. Singer and his co-workers soon concentrated on *Psilocybe cubensis* in their efforts to induce fruiting. Soon after, in the early 1960s, R. L. Kneebone reported that this robust mushroom species, which thrives across subtropical climate zones, can also be induced to fruit on a rye-grain medium.

Counter-Cultural Expertise Gains Mainstream Acceptance

In the mid-1960s, *Psilocybe cubensis* became the species of choice for experiments that made use of submersed fermentation to investigate the biosynthesis of psilocybin from tryptophan and other precursors. We should note in this context that around the same time, this technique was also used to obtain mycelial pellets of the species *Psilocybe baeocystis Singer & Smith,* providing the material for the first-ever isolation of baeocystin from mushroom tissue.

From the 1970s on, a growing number of books were published in the United States that distributed information acquired by members of the counter-culture on the cultivation of psychotropic mushrooms. The scope of these books soon narrowed, with a primary emphasis on *Psilocybe cubensis,* which may be explained by the fact that, initially, only R. Heim's research results were published, thus making them available to a larger audience.

In 1971, new results were published

about the champignon's ability to fruit on a rye-grain medium, provided a cover layer was added on top. It wasn't long before these findings were applied to the cultivation of *Psilocybe* species.

By 1932, J. Sinden had already published a patent for a cultivation process that involved the inoculation of mushroom mycelia derived from champignons into horse dung compost (a medium widely used for cultivation purposes) but only after the mycelia had already grown to permeate a medium of sterilized grains. Since that time, this process has mainly been used in the production of table mushrooms, specifically, for manufacturing the spawn to be placed onto the compost without inducing fruiting on grain. *Psilocybe cubensis* fruits after about three to eight weeks on this substrate.

If a moist cover layer is added (e.g. a peat moss/lime mixture, 2:1), the yields may double. However, this process is risky, because over-saturation can render the containers non-sterile and invite contamination from bacteria and molds. Most authors prefer a mixture of rye and water that has been inoculated with mycelia from an agar culture. Still, rice, barley, wheat and other grains have also been used with varying degrees of success. Figure 52 shows that, after about five weeks, small mushrooms even grew on wet pages of a newspaper that used to be the official print medium controlled by the former East Germany's SED Party ("Sozialistische Einheitspartei Deutschlands" or "Unified Socialist Party of Germany").

Some Recent Findings

Today, *Psilocybe cubensis is* clearly one of the most easily cultivated mushroom species around and it can thrive on a large variety of substrates. Naturally occurring specimens are most often found growing on cow dung. Generally, the species tends to grow on dung and straw as a primary decomposer, but the mushrooms can also utilize nutrients previously converted by other organisms, such as various types of compost, among others (see Figure 53, p. 77).

Within the scope of this book, it is impossible to discuss all details pertaining to the fruiting process of psychotropic mushroom species. P. Stamets and J.S. Chilton are the authors of two outstanding books that deal with all the technical and practical aspects of mushroom cultivation. The psychotropic species are included along with information about many kinds of culinary mushrooms. Still, I would like to make special note of the fact that *Psilocybe cubensis* cultures benefit when horse or cow dung is added to the original nutrient mixtures, as evidenced by the mushrooms' relatively faster growth rate and the development of comparatively more robust specimens (see Figure 45, p. 71 and Figure 49, p. 74). Before adding the dung to the nutrient mixture, however, it must first be suspended in water and autoclaved, which considerably reduces the risk of contamination. Only then should the suspension be added to the rye grain substrate and sterilized once more.

In spite of numerous claims in the popular literature, most attempts by laypersons to cultivate fruiting bodies of *Psilocybe cubensis* on rye grain substrate are thwarted by the presence of contaminating agents such as bacteria and molds. Even though mushrooms are organisms that do not perform photosynthesis and thus are no longer thought of as plants, some mushroom species, including *Psilocybe cubensis,* are heliotropes, meaning they will grow toward stationary sources of light. All *Psilocybe* species examined to date require light to promote the biochemical process in the mycelia that will induce fruiting. Additional exposure to light is needed, if the fruiting bodies are to develop into normal shapes and produce spores.

Apart from a series of interesting physiological experiments performed by E.R. Badham during the 1980s, there are a few other noteworthy substrates for cultivation of Psilocybe *cubensis* fruiting bodies. For instance, we were the first to discover that a new type of plant hormone (brassinosteroids) will accelerate fruiting of the mycelia (Figure 40, p. 64). During these experiments, we were also able to completely suppress the formation of psilocybin and psilocin through high concentrations of phosphate. It is now possible to design future physiological experiments to study different hallucinogenic mushroom species under these conditions.

In recent years I have also succeeded at cultivating the European hallucinogenic mushroom species.

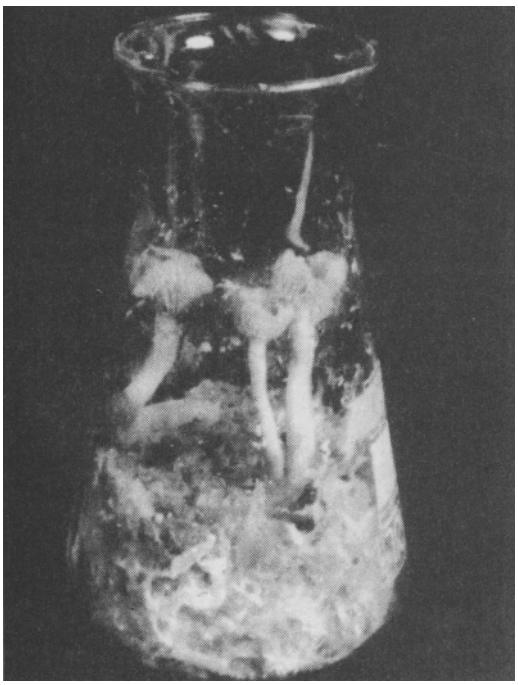


Figure 43 - *Gymnopilus* purpuratus fruiting on wet rice and saw dust.

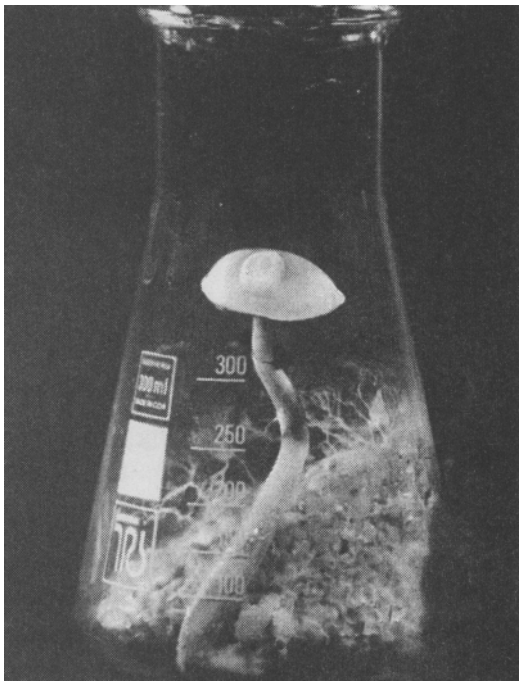


Figure 44 - *Psilocybe bohemica* on a rice substrate.

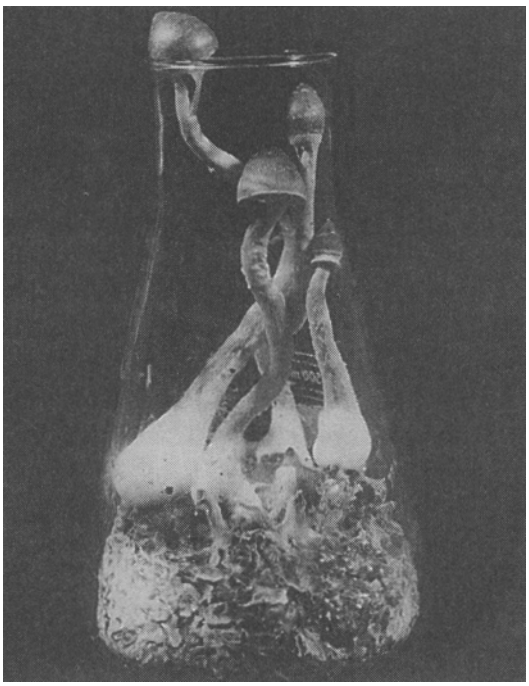


Figure 45 - *Psilocybe cubensis* fruiting bodies grown an a mixture of cow manure and rice.

Psilocybe semilanceata is a mushroom species whose mycelia grow at a significantly slower rate than the mycelia of *Psilocybe cubensis, Gymnopilus purpuratus, Panaeolus subbalteatus* and *Psilocybe bohemica.* Despite the fact that only a few strains of *Psilocybe semilanceata* actually fruited, cultivation of this species succeeded with different substrates. After a mycelial growth period of three to four months, the mushrooms emerged on compost (see Figure 46) as well as on a mixture consisting of grass seeds, dung, and rice (see Figure 66, p. 116). Four flushes of fruiting bodies were observed.

Panaeolus subbalteatus also fruited after 92 days on a mixture of cow dung and damp rice. The physical appearance of these fruiting bodies differed considerably from specimens of the same species that had grown on naturally occurring substrates (Figure 3, p. 6 and Figure 51, p. 76).

According to Stamets and Chilton, *Panaeolus cyanescens is* a species that does not fruit without a cover layer. However, this statement does not seem very plausible, considering the species can be found, much like *Psilocybe cubensis,* growing on top of dung under natural conditions.

Psilocybe bohemica was another species that fruited on damp rice after two or three months. These in-vitro specimens also appeared to be much hardier in comparison to fruiting bodies collected at a natural location near Sazava, Bohemia (Czech Republic). The cultivated specimens even developed two (!) rings, yet these robust mushrooms did not fruit until after an exposure to the shock of cold temperatures (see Figure 44, p. 71).

At about the same time, *Gymnopilus purpuratus* fruited on a moist mixture of rice and saw dust after six to eight weeks (see Figure 43, p. 71). In this case, however, the cultivated mushrooms turned out to be smaller than fruiting bodies that developed from fruiting mycelia on wood shavings at a location outside the laboratory (Figure 30, p. 40).

During the 1980s, there were also reports about success in cultivating psilocybin-containing sclerotia of *Psilocybe mexicana* and its close relative *Psilocybe tampanensis Guzman &* Pollock. In both cases, the sclerotia form after three to twelve weeks, preferably in the dark on a substrate of lolium (rye grass) seeds. All strains of *Psilocybe tampanensis* originate from a single fruiting body that was found near Tampa, Florida in 1977. Sclerotia from this species have also been cultivated on a straw substrate. Compared to lolium seeds, soft rice has the advantage of not drying out as fast, so that the sclerotia will form more evenly than they would on rye grass seeds. A photograph of *Psilocybe tampanensis* sclerotia is shown on page 117 (Figure 69).

Psilocybe natalensis, which we first discovered in South Africa in January 1994 (see Chapter 7.6), is another species that easily fruits, within four to eight weeks, on compost or on straw with potting soil for a casing.

In closing, I would like to comment on the mycorrhiza problem. Due to the close interrelationship between mushroom mycelia and their symbiotic partner trees, there exists a unique exchange of growth hormones and other products - substances whose study has only just begun. For this reason, all attempts to fruit these species in-vitro have remained unsuccessful. Nonetheless, we were able to start mycelial cultures from some of these species, but in most cases, growth rates remained very slow. As a result of my own investigations, I was able to isolate sterile cultures from *Inocybe aeruginascens* (see Figure 50, p. 75), which grew and developed greenish sclerotia at the same time. The dried mycelial mass contained about 0.1 % psilocybin, Figure 48 (p. 74) shows three *Inocybe aeruginascens* fruiting bodies whose mycelia grew naturally. These mycelia were found to contain no baeocystin and less psilocybin (0.05%) than the fruiting bodies shown in Figure 48.

Several months after these mycelia had been isolated from spores and fruiting body tissue samples, they began to degenerate and lost their ability to sustain growth, most likely because information available about conditions and requirements for optimal growth was insufficient.

Incidents of mycelial degeneration in saprophytic species have rarely been described in the literature. However, this condition can be easily prevented through usage of more than just one type of nutrient media; thus, the specific composition of a medium should be changed from time to time. In addition, only fast-growing mycelial threads (rhizomorphs) should be selected for propagation. By contrast, prolonged degeneration of strains can be caused by new inoculations of material taken from agar-based

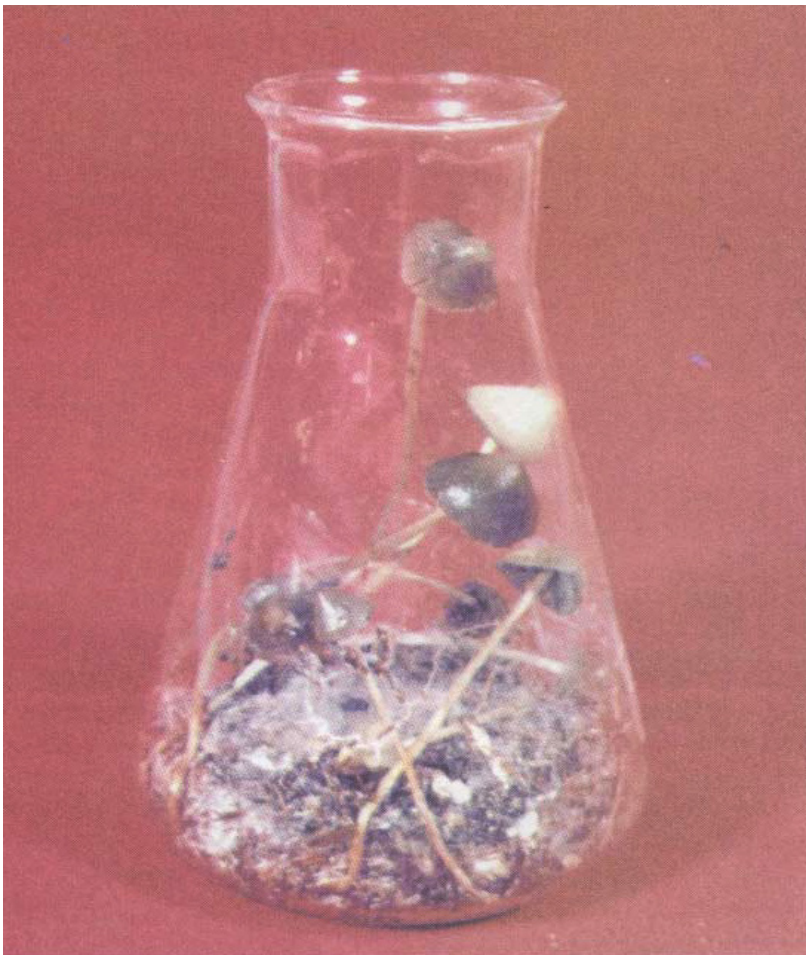


Figure 46 - *Psilocybe semilanceata* on compost

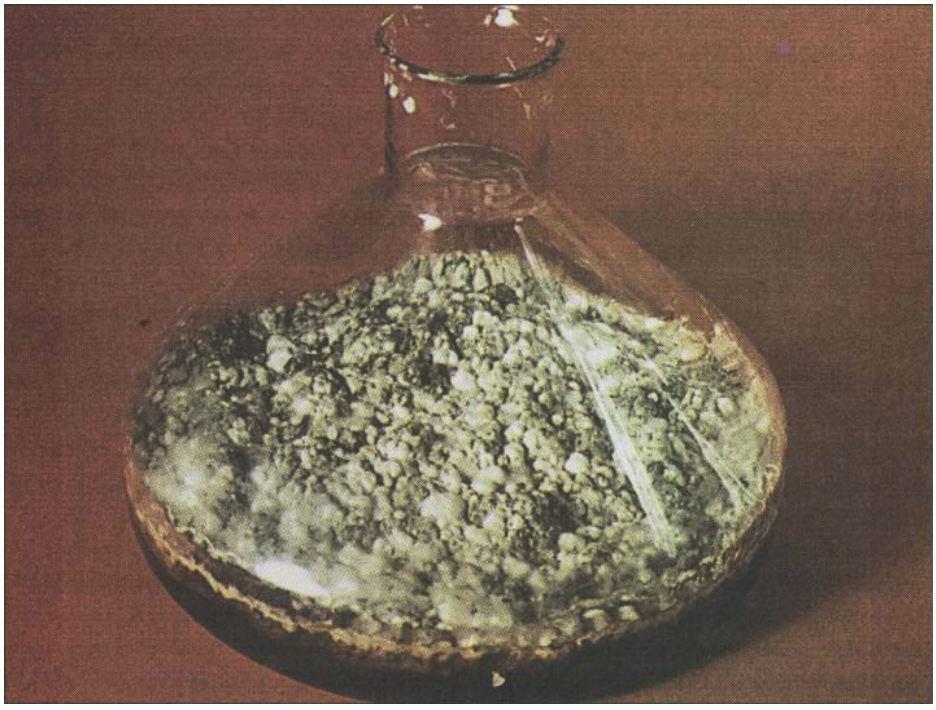


Figure 47 - Surface culture of *Psilocybe semilanceata* (with sclerotia formation).

Figure 48 - *Inocybe aeruginascens* on grassy soil

Figure 49 - *Psilocybe cubensis* on horse manure and rice.

portions of mycelia whose texture is somewhat like wool. The kind of viruses known to appear in champignon cultures - where they have already caused a lot of damage - have so far not been found in cultures of the *Psilocybe* and *Panaeolus* species.

It is safe to say that we currently know a great deal about the nutritional requirements of *Psilocybe cubensis. To* a lesser extent, such information is available about other species as well. Armed with this knowledge, future researchers may well discover new insights into physiology of these species, as well as the biochemical changes that occur during fruiting.

In my experiments, it has already been established that the process of differentiation whereby mycelia are transformed into sclerotia or fruiting bodies is linked to increased production of psilocybin as well as psilocin, especially in *Psilocybe cubensis.*

Due to the relatively complex methodology and the type of equipment needed to isolate and maintain sterile cultures, it appears unlikely that cultivation of *Psilocybe cubensis* mushrooms by laypersons will significantly heighten the mushroom's popularity or widen its area of distribution anytime soon.

However, since the early 1980s, growing numbers of mycophiles in North America and Europe have successfully used "natural outdoor cultivation" to fruit *Psilocybe cyanescens* and similar species. This process involves selection of natural wood substrates striated with mycelia (rhizomorphs) that usually turn blue in response to handling. The mycelia are then transferred onto fresh wood chips or commercial mulch (not from cedar trees). After several months of growth, the mycelia fruit during the fall season.

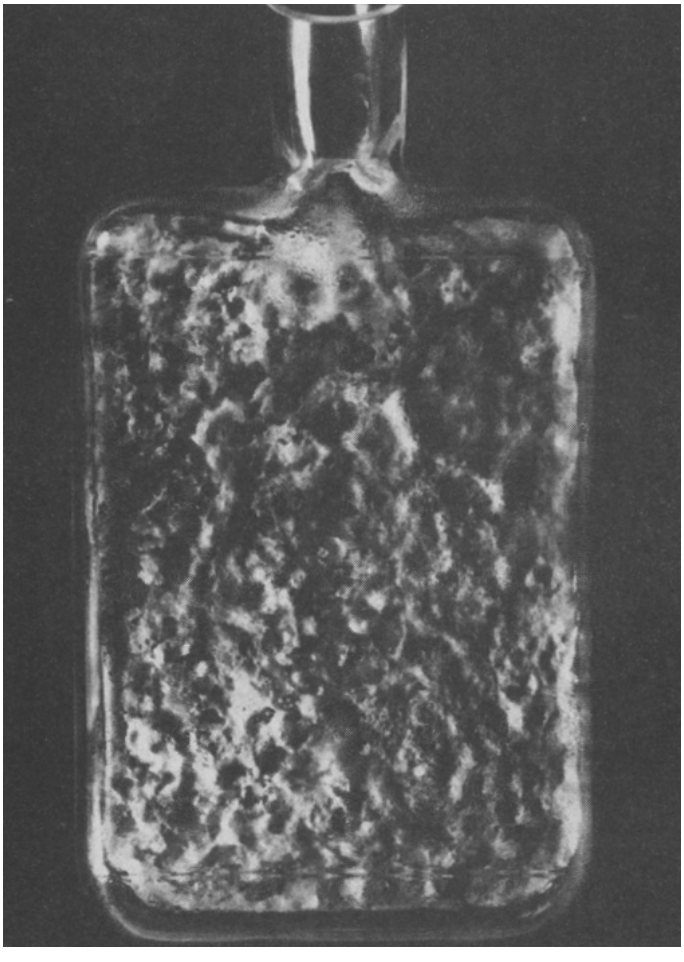


Figure 50 - Surface culture of *Inocybe aeruginascens* on a liquid nutrient medium.

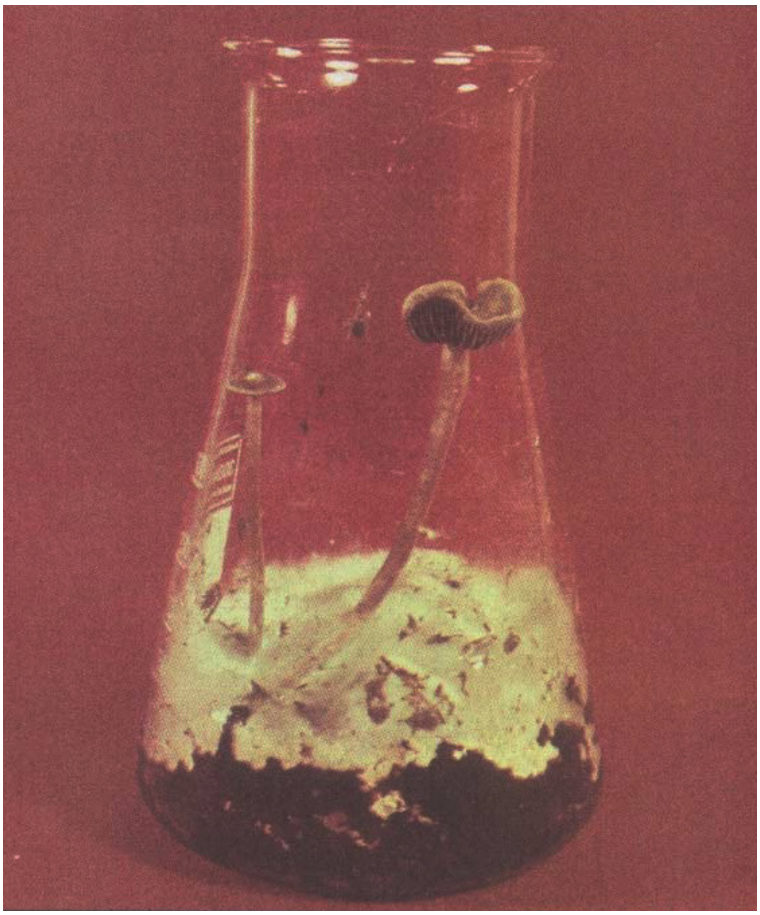


Figure 51 - *Panaeolus subbalteatus* on cow dung and rice.

Figure 52 - *Psilocybe cubensis* on wet newspaper.

CHAPTER 7

PSYCHOTROPIC MUSHROOM SPECIES

AROUND THE WORLD

Figure 53 - *Psilocybe cubensis* on compost.

Figure 54 - *Psilocybe stuntzii* (grasslands variety) from British Columbia.

Figure 55 - Giant mushroom sculpture from Kerala, India. There is considerable debate among experts about the significance and purpose of the sculpture.

Figure 56 - Magic mushrooms & water buffalo t-shirt from Thailand, designed for the Western tourist market.

CHAPTER 7.1

SPOTLIGHT ON NORTH AMERICA AND HAWAII

In 1961, V.E. Tyler became the first investigator to report the detection of psilocybin in *Psilocybe pelliculosa (Smith) Singer & Smith,* a North American mushroom species. One year later, two research groups, working independently, discovered psilocybin, as well as psilocin, in samples of *Psilocybe baeocystis Singer & Smith* from the Pacific Northwest region of North America. Additional chemical and taxonomic findings on that region's mycoflora have been published up to the present day. This area includes the states of Washington (USA), British Columbia (Canada) and western Oregon (USA). The region is considered a major center of psychoactive mushroom use in North America. Some areas along the U.S. Gulf states have acquired similar reputations.

In 1966, Heim and his colleagues reported that an unknown *Psilocybe* species had been confiscated in Canada. The mushrooms appeared to be very similar to *Psilocybe semilanceata.* Shortly thereafter, A.H. Smith determined that the same mushroom species was popular among students in Vancouver. It wasn't long before *Psilocybe semilanceata* was recognized as a species quite common throughout the Pacific Northwest. Moreover, the mushrooms turned out to indistinguishable from European *Psilocybe semilanceata* samples.

The Spread of *Psilocybe semilanceata*

From the late 1960s onward, *Psilocybe semilanceata* usage increased, particularly in areas between the Pacific Ocean and the Cascade Mountains that range from Southern Oregon north to British Columbia. It is likely that during these years, Tom Robbins's popular book *"Another Roadside Attraction "* significantly contributed to the mushroom's increasing popularity. Today, *Psilocybe semilanceata is* the most widely used species in the Pacific Northwest, and its habitat is expanding into pasture lands east of the Cascade Mountains.

As in Great Britain, the mushroom is referred to as "Liberty Cap" in the United States. *Psilocybe semilanceata* has the reputation of being one of the most potent species without generally causing unwanted physical side effects (also see Chapter 3-1). As indicated in previous chapters, recurrent claims about different types of effects from different psychoactive species should be systematically studied, including comprehensive biochemical analyses. These research efforts will likely uncover new biodynamic ingredients.

Another factor that accounts for different types of effects is the variability in levels of alkaloid content. In the course of casual experimentation it is also not uncommon for a number of expectations to become self-fulfilling. The assumption that *Psilocybe baeocystis* (see Figure 72, p. 119), a strongly bluing species, causes a comparatively larger number of physical problems than other species is undoubtedly rooted in the mushroom's "reputation" as being the only *Psilocybe* species to date responsible for the only known fatality involving *Psilocybe baeocystis* - a child who died after eating some of these mushrooms (see Chapter 8 for more details on this incident).

Psilocybe baeocystis primarily grows in inland areas of the Pacific Northwest, on top of wood debris and on lawns in parks. It is a species that can often be found and collected on school and university campuses. *Psilocybe pelliculosa,* a mushroom mentioned in previous chapters, is a species also known as "Liberty Cap". Macroscopically, it is extremely difficult to distinguish from *Psilocybe semilanceata.* Unlike the latter species, however, *Psilocybe pelliculosa will* grow in forests on wood chips and sawdust.

Beug and Bigwood were able to furnish analytical proof in support of the claim that *Psilocybe pelliculosa is* weaker in its psychotropic effects than comparable species. *Psilocybe pelliculosa* contains about 30-50% of the amount of psilocybin found in *Psilocybe cyanescens* (slang names: *Blue wavy, Cyan, Grandote),* a species common across the Pacific Northwest. It fruits primarily in parks, forming partial fairy rings. This species did not become popular

among users until the mid-1970s.

A New Psychoactive Mushroom

Several additional *Psilocybe* species have been found in the Pacific Northwest, even though the taxonomic classification of most of these species remains inadequate, despite the fact that monographs such as those by P. Stamets offer quite detailed descriptions of the psychotropic mycoflora. In the mid-1970s, Guzman and Ott reported a rather spectacular event concerning the spread of a "new" mushroom species. During the fall of 1972, large numbers of a strongly bluing gilled mushroom with a distinct ring pattern were found at the University of Washington in Seattle. The fruiting bodies were found growing on bark mulch, which came from a central distribution point and which had been spread widely across the campus by gardeners. Due to the bluing reaction, students at the university assumed that the mushroom contained psilocybin, a belief that was confirmed later on. The sudden appearance of massive numbers of fruiting bodies quickly inspired students at the university to use the mushrooms as a hallucinogen.

In my opinion, it is still uncertain if the mushroom really appeared spontaneously, or whether it fruited on bark debris simply because the substance had previously been mixed with spawn derived from fruiting bodies that originated elsewhere.

In any case, in 1976, the mushrooms were named *Psilocybe stuntzii Guzman & Ott* (slang name: "blue veil" or "stuntzees", (see Figures 54 and 71). Today, the species can be found growing on bark and on lawns in parks, on golf courses, football fields and gardens in numbers so large that it is considered the second most important species in terms of usage, after *Psilocybe semilanceata.* In addition, *Panaeolus subbalteatus is* another regionally important mushroom species (slang name: "red cap"), even though its users believe it to be slightly more poisonous than the *Psilocybe* species. Still, the mushroom is used quite frequently, because it begins to fruit during the spring. The *Psilocybe* species, on the other hand, do not appear until fall and continue to grow into early winter, when temperatures consistently drop below freezing, which inhibits further fruiting of the species. Under favorable conditions, only *Psilocybe stuntzii* can fruit year-round, even though this species still fruits most abundantly in the fall.

Mushroom Trips as a Popular Sport

In 1977, J. Ott estimated that several tens of thousands applied dosages of psychotropic mushroom material are harvested and used each year, particularly in the Pacific Northwest. Despite these quantities, there have never been reports of fatalities or serious physical damage as a consequence of using the *Psilocybe* or *Panaeolus* species. Local papers merely mentioned occasional panic reactions that subsided as soon as the acute effects of the mushrooms had worn off.

The usage of psychotropic mushrooms in the United States tends to cluster geographically in areas that are considered mushroom Eldorados. For example, the city of Redmond, WA used to be known as the "bicycle capital". Since 1978, several newspapers have renamed this city the "psilocybin capital".

Since the late 1960s, the usage of *Panaeolus cyanescens* and its closest relatives has become fashionable in Hawaii, even though the taxonomic differentiation of the *Panaeolus* species from each other is extremely difficult. There were initial attempts to preserve the fresh mushrooms by freezing them with dry ice (solid carbon dioxide) for export to the Pacific Northwest and Southern California. Apparently, these entrepreneurs were unaware of the fact that psychoactive ingredients will remain stable, as long as the mushrooms are dried and stored at temperatures below 50'C (122'F). Such export efforts were soon abandoned, because freezing the mushrooms turned them to mushy pulp that was difficult to transport. In addition, several local species had been discovered in the Pacific Northwest. During the early 1970s, fruiting bodies of the *Panaeolus* species preserved in honey began to appear on the black market in Hawaii and, on occasion, in North America. Again, this method fell short, because mushrooms could be preserved for only short periods of time.

Panaeolus subbalteatus grows in several areas in the Hawaiian Islands, but it is used less frequently than other *Panaeolus* species. Even though one often hears about "Hawaiian strains" of *Psilocybe cubensis,* the species is not native to The Islands and should grow there only under conditions of artificial cultivation. Any spawn used for cultivation, however, must have been

isolated from fruiting bodies that originated elsewhere. In Hawaii, the extent of adverse reactions was also limited to a few panic reactions observed in recreational users who had ingested mushrooms of the species *Panaeolus cyanescens.* In 1972, an apparent fatality was definitely not caused by ingestion of mushrooms, but instead was most likely the consequence of a heroin overdose, as reported by J. Allen, who has researched this incident extensively.

The legislatures in North America and Hawaii do not pay very much attention to the usage of psychoactive mushrooms. The identification of species is often quite difficult, so that police enforcement activities primarily target misdemeanors such as parking violations and the willful destruction of fences around pastures. The latter is not uncommon during attempts to force entry into areas where *Psilocybe semilanceata* can be found.

In December 1979, the High Court of British Columbia ruled that the Canadian Narcotics law prohibits psilocybin only in its pure form, whereas mushrooms containing the alkaloid as a natural ingredient are exempt from the law. This decision seems both realistic and reasonable, considering the substantial, uncontrollable spread of these mushrooms and an ongoing battle against truly addictive drugs that requires all available efforts and resources.

Even though the extent of prosecution of drug law violators in Canada and the U.S. varies from state to state, psilocybin-containing mushrooms are only a minor factor in the overall "war on drugs". In California, however, mushroom cultures are illegal, as well as spore prints (!) from the *Psilocybe* species. Spore prints, however, are impossible to control. *Psilocybe cubensis is* common across the South, and *Panaeolus subbalteatus* grows across the Southwestern U.S., where the mushrooms are used extensively. By one estimate, there were 100,000 "Magic Mushroom People" in the state of California alone, a number likely to be much higher today. The demand created by this growing market is probably being met through cultivation of *Psilocybe cubensis.* These users ingest psychotropic mushrooms as a form of recreation, or incorporate them in the ritual practice of natural mysticism. Other users prefer mushrooms as an aid to meditation or to attain communication with the realm of the divine. Regardless of motivation, users tend to lead secluded, self-sufficient lives in close proximity with Nature. Across North America, the total number of magic mushroom consumers is likely close to one million, quite possibly higher.

By the early 1980s, prominent experts in the field had estimated that the number of hallucinogenic mushroom users in the United States outnumbered LSD users for the first time, a trend that went hand in hand with a rise in environmental awareness. In this context it is interesting to note that the Drug Abuse Warning Network (DAWN), which collects data from throughout the United States, documented only 31 cases of clinical interventions for usage of psilocybin-containing mushrooms in 1982. In some of these cases, the mushrooms were used in combination with other substances, confusing the pharmacological picture. In comparison, LSD was involved 1,498 times, while marijuana was cited in 5,295 cases. It should be noted that the high number of marijuana cases cited appears inflated and suspect, in light of data from other studies.

It is interesting to note that T. Leary's psilocybin experiments during the early 1960s provoked severe reactions of a moralistic-puritan nature, while medical reports about prolonged psychoses and other such side effects did not appear until the "LSD era" some years later.

North America's mushrooms offer many opportunities for additional taxonomic work and many more still remain to be discovered. To illustrate, a new mushrooms species was recently reported from Oregon. The mushroom, *Psilocybe azurescens Stamets & Gartz is* unusually large and very potent due to its high psilocybin content. North America's rich mycoflora, particularly in regions of wet climates in the eastern and midwestern United States is wide open for further research efforts that may well yield valuable and amazing new results.

As early as 1909, Murrill described *"Inocybe infida",* a mushroom with "narcotic" effects from New York. In 1911, Ford named *"Inocybe infelix"* as a species that also caused strange effects, without inducing symptoms of muscarine poisoning. These descriptions immediately bring to mind the psilocybin-producing fibreheads, even though visionary experiences are not expressly mentioned.

In the future, we should expect an increase in usage of local, psychoactive species from locations across the U.S. and Canada.

CHAPTER 7.2

MYCOPHILIA IN CENTRAL AND SOUTH AMERICA

Compared to the time of Wasson and Heim's discovery, recent decades have brought significant changes to several regions of Mexico in terms of how local Indians relate to the psychotropic *Psilocybe* species. In many remote parts of the country, mushroom cults still exist in their specific contemporary forms which combine Christian views with elements from pagan and pre-Christian Nature religions.

By contrast, in other parts of the country, mushroom rituals have fallen into disuse in the wake of interaction with Mexico's "modern life" and its tourism industry. When Guzman investigated the taxonomy and geographic distribution of *Psilocybe aztecorum Heim* in 1978, he noted that several active "curanderas" had been the focal point of sacred mushroom worship 20 years earlier. Today, the next generation of Indians no longer ingest the mushrooms and consider the hallucinogenic species to be nothing but a popular trading commodity for Western tourists.

Starting in the 1960s, large numbers of young people from industrialized nations ("hippies") began to visit the centers of mushroom worship as tourists, favoring the state of Oaxaca. They came mostly from the United States, and initially their main destination was the village of Huautla de Jiminez, to visit Maria Sabina, who guided R.G. Wasson during his first mushroom session in 1955. To the extent that magic mushrooms have been labeled "fool's mushrooms" or "joker's mushrooms" in Europe, it is interesting to note here that Maria Sabina herself repeatedly referred to the mushrooms as "clowns" and called herself "chief of the clowns" or "lord of the clowns". In Mexico, magic mushrooms are also known as "mushrooms of pure laughter".

Today we know that this run on Mexico's mushrooms helped destroy the cultural identity of the native Indians, causing discontent and rising crime rates in several villages. Self-appointed "curanderas", with no traditional roots, presided over mass ceremonies with magic mushrooms. Participants who had panic reactions did little to ease tensions among the local population. Finally, the police and the army were called in to put an end to the resulting turmoil. Mushroom tourism in Mexico dropped off rapidly, especially after similar species were discovered in other countries. Despite legal prohibitions, however, various *Psilocybe* species are still being sold to tourists in some areas of the country today. This phenomenon is not limited to Mexico. In the mid-1970s, Lowy reported from Guatemala that Indian children near the capital city were offering *Psilocybe mexicana Heim* for sale to foreigners, a trading practice that has been observed in other parts of the country as well.

Experts on bluing gilled mushrooms, who travelled to South America and the Caribbean, discovered several psychotropic species (e.g. *Panaeolus cyanescens* in Jamaica), even before mycological research established the existence of these species. According to those few scientific publications on taxonomic identity, the two most commonly used species are *Psilocybe cubensis* and *Panaeolus cyanescens.* Around 1970, tourists who had previously been looking for *Psilocybe* species in Mexico learned that they are abundant among Colombia's mycoflora as well. Consequently, knowledge about these mushrooms spread quickly among Colombian youngsters, possibly as a result of Central America's Indian tradition. Thousands set out in search of these species in and around their areas of residence. Special communes were formed, situated in idyllic regions of the Andes Mountains. The most famous among them was known as La Miel ("honey"). *Psilocybe cubensis* and the *Panaeolus* species were also found to be common across those regions of Amazonia where Colombia, Peru and Brazil share common borders. The archaeological park at San Augustin near Bogota has been dubbed "heart of the magic mushroom land". These species have also been used in Peru. During the 1980s, road side signs proclaiming "No To San Ysidro Drugs!" were a common sight. The slogans referred to *Psilocybe*

cubensis under an old name. South America's problems, however, cannot be solely blamed on the ingestion of indigenous, non-lethal mushrooms. Socio-economic problems are rooted in poverty and destitution, epidemics, civil warlike conditions in some parts, as well as the rampages of the cocaine mafia. Today, Argentina and Brazil are two countries where magic mushroom use is still common. In 1975, Pollock reported the practice of mixing a drink from milk, honey, bananas and magic mushrooms.

In terms of interdisciplinary research in Central and South America, there remains the vast challenge of uncovering additional clues about ritual usage among early cultures, coupled with efforts to trace and analyze more recent kinds of uses. Chapter 3.5 already included one historic account of magic mushroom use several centuries ago. A large number of golden pendants in a variety of mushroom shapes have been found in Colombia, suggesting that magic mushrooms have been used there for centuries. At the same time, research into the taxonomy and chemistry of South American psychotropic species has barely just begun.

CHAPTER 7.3

THE AUSTRALIAN MYCOLFORA ATTRACTS ATTENTION

In 1934 J. Cleland publicized the existence of 12 mushroom species of the genus *Psilocybe* in South Australia. Up to that time, there had been no accounts about psychotropic intoxications from the fifth continent.

Cleland was probably the most renowned Australian mycologist of the 20th century. As early as 1927 he had already described a new species named *Psilocybe subaeruginosa.* This mushroom grows in New South Wales, Victoria and South Australia and turns bluish-green with age or in response to pressure. During the 1940s several accounts surfaced which detailed a series of "hysterical psychoses" caused by *Panaeolus ovatus Cke. & Mass.* (also see Chapter 3.3).

In 1958, Aberdeen and Jones described the geographic distribution of *Psilocybe cubensis* across the southeastern valleys of Queensland and New South Wales. They speculated that this was the mushroom responsible for the cases of intoxication, not the *Panaeolus* species. They proposed this hypothesis, because the mushrooms in question were thought to have been champignons, who resemble the fleshy *Psilocybe* species much more closely than any of the *Panaeolus* species. In addition, the *Psilocybe* species had been described as being much more common in the area. Under wet climate conditions, the *Psilocybe* species can be found growing in abundance on cattle dung, especially along the sunshine coast of Queensland, in the open valleys around Brisbane and in areas that used to be rain forests, but have now been transformed into pastures. It is quite likely that the species was brought into the country by its early settlers. It wasn't until the early 20th century that land in Australia's subtropical and tropical regions was converted into pastures.

Today, it is generally thought that the mysterious *Panaeolus ovatus* species was, in reality, *Panaeolus cyanescens.*

It wasn't until the early 1970s that the latter species was identified. Soon after, the *Panaeolus* species were recognized as being very common throughout Northern and Southern Australia.

Despite the widespread geographic distribution of psychotropic species in Australia, there were only a few efforts to publish information about their chemical composition. In 1970, Picker and Rickards reported the isolation of 0.45 % of psilocybin from dried fruiting bodies of *Psilocybe subaeruginosa,* but failed to find any psilocin in that sample. Later on, other authors reported only about one-tenth of this amount of psilocybin, a number that I believe to be too low, considering reports about the mushrooms' strong psychoactive effects.

Psilocybin was also found in Australian samples of *Psilocybe cubensis* (see Figure 2, p. 5), while *Panaeolus cyanescens* was reported to contain psilocybin, along with even higher levels of psilocin and serotonin as well.

Starting in the late 1960s, popular, widespread usage of psychotropic mushrooms began to catch on in Australia. At the same time, these accounts of mushroom use were the only comprehensive reports that originated in a country other than Mexico.

In the summer of 1969, a 4,000-hectare-region near the coast of Queensland gained notoriety because of its *Psilocybe cubensis* crop that grew there after the rainy season. Interested collectors flocked to the area in droves. Media reports at the time gave the impression that the mushrooms were an entirely new discovery, completely disregarding Central American traditions. *Psilocybe cubensis* conquered the black market, where the mushrooms were sold for about U.S.$1 per fruiting body. In the wake of an above-average rainy season, the species fruited so abundantly that special transportation companies were founded for delivery of the mushrooms to Australia's large cities.

However, even here the mushrooms did not grow in heaven: the epidemic subsided somewhat, and the usage of psychotropic mushrooms became endemic across all of Australia. On May 8, 1971, the governor of the conservative state of Queensland prohibited

possession of *Psilocybe cubensis* and the species fell under the same legal guidelines as *Cannabis sativa* (hemp) and *Papaver somniferum* (opium poppies).

Still, usage of the *Psilocybe* species continued, despite harsh penalties for possession and use (a total of 74 individuals were sentenced in 1972, and 27 in 1973).

Also, those interested in mycological field research continued to study *Psilocybe subaeruginosa* and even discovered the species in the northern part of the country. Like *Psilocybe cubensis,* this species is also known by the colloquial name of "gold top", whereas *Panaeolus cyanescens,* a species that wasn't discovered until later, acquired the nickname "blue meanies" within the counterculture (an expression that refers to a collection of several fruiting bodies). It is likely that these mushrooms were named after the small blue men featured in the classic psychedelic Beatles movie "Yellow Submarine", which was released in 1968.

In colloquial Australian English, "mushies" is a commonly used short form for "mushrooms".

Next to fresh mushrooms, "processed" preparations also began to appear on the black market: In Hobart, Tasmania, for example, dried and ground up mushrooms packaged in gelatine capsules were sold for $6 a fruiting body. The availability of mushroom-based hallucinogenic substances drastically reduced the market share of LSD, which was generally a lot more expensive. By 1972, LSD had almost disappeared from the black market.

Based on Southcott's (1974) writings, it is likely that the unpleasant taste of fresh specimens of *Psilocybe cyanescens* was the main reason for the processing of the fruiting bodies.

Bizarre Reactions

Considering the widespread use of psychoactive mushrooms in Australia, there were only a handful of reports about medical complications, amounting to only minor complaints from a few individuals. Symptoms were almost exclusively limited to panic reactions due to excessively high doses. These reactions were precipitated by bizarre psychic sensations, which the person was unable to integrate. *One 17 year old teenager, for example, developed a panic reaction when she suddenly felt like a banana that was being peeled* (Southcott). In all cases, symptoms disappeared within several hours as the psilocybin wore off. While a few cases included complaints such as stomach cramps and kidney pain, these symptoms are not characteristic of the *Psilocybe* species and their relatives. It is likely, that other, poisonous, mushrooms, such as muscarine-producing species, were to blame for these syndromes.

I would like to close this chapter with a report from an Australian mushroom lover, who illustrates the reasons and circumstances of psychoactive mushroom use in Australia (Southcott)

Report about the effects of a "gold top " mushroom:

The mushrooms which were prepared in a broth and boiled for about two minutes may be used to induce an extremely powerful hallucinatory trip. When eaten raw, the effects can take up to two hours to come on, but taken in soup form they can begin to occur within five to ten minutes of being eaten. The first noticeable effect is a tingling sensation from head to toe, followed by extreme warmth or cold throughout the body. Mild hallucinations begin to occur within a quarter of an hour and become stronger as the trip reaches its peak. This peak can be a terrifying experience for the novice; individuals may not know what to expect and may believe they have gone insane. In many cases, this . "insanity" can also be pleasurable and can cause a person to lose all fear of things which had previously seemed impossible to bear. Everything material and otherwise is laid out in front of you for examination and nothing is beyond human comprehension. In my opinion and experience, these mushrooms, when used by persons capable of understanding the tremendous power contained within them, can only be beneficial in their effects.

I have found them (Psilocybe subaeruginosa - Southcott) growing in flatbottomed valleys and on gentle slopes. They thrive in moist, grassy soil and can range in size from a quarter of an inch up to two or three inches in diametre. In regard to an overdose of these mushrooms, this user feels that it is not really an accurate term for this condition. It is more an extreme fear of certain things or people

that causes 'freak-outs ". The trip can change from one of fear and hysteria to one of pure ecstasy in a matter of a second, if a person is treated correctly. The police, in my opinion, are the cause for more bad experiences than all other factors combined. I myself have almost lost all fear of everything I previously dreaded. I intend to continue the use of these mushrooms and see

where it leads me, whether it be a good (lawful) or bad thing....

Description: The mushrooms (Psilocbe aeruginosa Southcott) have caps colored yellow to dark brown on top, and cream-colored to almost yellow underneath. If picked fresh, the stem and parts of the cap will turn green and blue or sometimes violet. This discoloration does not occur until after the mushrooms have been picked.

CHAPTER 7.4

EUROPEAN CUSTOMS

The first report ever published in a scientific European journal about usage of *Psilocybe semilanceata* in Europe was written by M. Carter and appeared in *New Scientist* in September 1976.

"Mushrooms Are Mushrooms"

The mushrooms quite suddenly emerged in the spotlight of public attention in 1976, when Judge Blomefield of Great Britain's High Court handed down a verdict of "not guilty" in the trial of a man accused of possession of psilocybin in the form of dried fruiting bodies from the species *Psilocybe semilanceata.* According to Carter's report, the acquittal was justified as follows: *"Psilocybin is a chemical and mushrooms are mushrooms".* In the wake of this decision, however, a few individuals in Britain were nonetheless sentenced for possession of psilocybin, because the British legal system is based on the principles of common law, which means that the High Court decision was not necessarily binding in cases that went to trial in lower courts after the man had won his acquittal in the High Court.

Despite its Celtic ancestry and the practice of Nature religions, England is among those countries whose population has traditionally been quite mycophobic in its attitudes toward mushrooms, which have always been thought of as poisonous, slimy and moldy. It is therefore quite remarkable that these values appear to be changing with the current younger generation. Could it be that England's Celtic heritage is making a reappearance after centuries of dormancy?

In 1978 , C. Hyde and his collaborators reported several cases of voluntary intoxications with *Psilocybe semilanceata* from a medical perspective, describing symptoms experienced by mushroom collectors that range from typically visionary experiences to the manifestation of acutely delirious states. The authors emphasized that the mushrooms were well-known within the hippie subculture of Manchester. Thirty to forty *Psilocybe semilanceata* mushrooms were considered an appropriate dose to attain a fully hallucinatory state.

According to British users, the effects of *Psilocybe semilanceata* include intense visuals without any of the negative feelings that may be caused by LSD. British colloquial names for the mushroom are quite poetic, such as:

- Liberty Cap
- Magic Mushroom
- Blue Legs
- Pixie Caps

Contrary to common opinion, "liberty cap" is not a new name, since M.C. Cooke mentioned it in his writings that date back to the 19th century.

Due to the widespread distribution of this *Psilocybe* species across England, particularly Scotland and Wales, *Psilocybe semilanceata* appears to be more popular in England than in any other European country, with the possible exception of Norway. This is an opinion echoed in numerous scientific and medical articles published on the subject in Great Britain. In my opinion, these publications contain the most detailed descriptions of casual use of psilocybincontaining mushrooms species by laypersons anywhere in the world.

One analysis by P.R. Mills and his collaborators described seven Scottish patients with symptoms caused by ingestion of *Psilocybe semilanceata* mushrooms during the fall of 1978, when the species fruited abundantly in the Glasgow area after heavy rainfall. Four of the seven men had eaten no less than one hundred mushrooms each, which meant they had taken about 50 mg of pure psilocybin a person. It is not surprising, then, that such dosages should cause visions that lasted several hours, along with marked somatic symptoms.

Mega Mushroom Festival

While there is talk about "hippies" in the report from Manchester, a 1980 newspaper article from Wales describes a "new kind of gypsy", whose exploits included a mushroom celebration near Cardiff with 100 participants. The occasion was the discovery of yet another bumper crop of *Psilocybe semilanceata* in that area. Nineteen of the revelers felt so seriously ill they had to seek medical treatment.

It appears that in the early days of mushroom usage in Great Britain, massive amounts of *Psilocybe* mushrooms were consumed on several occasions, which caused a higher number of panic reactions than elsewhere in the world.

However, it is clear from articles published in medical journals that these cases were merely "the tip of the iceberg", that is, they were a small group of users whose reactions to the acute stages of mushroom intoxication attracted attention because they included clinically relevant symptoms such as states of pathological depression with no recognition of surroundings.

In an attempt to describe patterns of usage of the *Psilocybe* species in the Tayside area near Dundee, Scotland, N.R. Peden and his collaborators found that the typical user was much younger there than in Manchester or Wales. The authors examined 27 patients, whose ages ranged from 12 to 24 years. I have previously cited accounts about accidental intoxications indicating that children can have abnormal reactions to psilocybin, such as cramps or loss of consciousness. Teenage use of hallucinogens and other psychoactive substances, including alcohol and nicotine can have disastrous consequences.

The results of a survey at two Scottish schools of 59 children aged 14 to 15 years revealed that 66% of them had already heard about the mushrooms' effects. Also, a paper published by R.E. Young and his research team in 1982 found that the mushroom users in the Glasgow area as a group are quite young. In 1981, these researchers treated 49 children and adults aged 12 to 28 years. These authors are correct in pointing out that the mushrooms cannot be eradicated due to their large area of distribution. At the same time, however, they demand that fungicides be sprayed on mushroom fruiting areas that are easily accessible!

This is a baffling and incomprehensible proposition - to acutely endanger all residents of a certain area by exposing them to poison, simply because there were a few mild cases of mushroom intoxications, with symptoms that soon disappeared. If anyone is to blame, it is the users for their carelessness and recklessness. Fortunately, these crypto-schizophrenic proposals were never implemented.

On the other hand, there are interesting statistics available from the poison center in London, about reported cases, where medical attention was required following ingestion of *Psilocybe semilanceata.* The numbers below show how many people received therapeutic treatment in Great Britain in a given year:

1978	33
1979	47
1980	96
1981	142

The average age of the mushroom collectors was between 15 and 19 years. Reports mostly came in during September and October of each year, which corresponds to the mushroom's fruiting period. Cases that were reported during other months of the year had been caused by ingestion of dried mushroom material.

In 36% of these individuals, the mushrooms caused significant visual distortions and visions. Five people acted aggressively without experiencing perceptual alterations. Dosage varied from half a mushroom (effects?) to up to two or three pounds. If the latter amounts have been reported truthfully, those individuals ingested about 1 to 1.5 g of pure psilocybin, assuming an alkaloid content of 0.1 % in fresh mushrooms. However, in cases where whole mushrooms had generally been eaten according to the Mexican tradition, liquids removed via stomach pumps largely contained whole mushrooms. Failure to carefully chew the mushrooms before swallowing means that only a fraction of the available amount of alkaloids is extracted from the mushrooms and absorbed by the body.

Panic Reactions

In cases when intoxications were caused by eating 'normal' amounts of mushrooms and the ingestion of potentially deadly species could be excluded, pumping the patients' stomachs turned out to be a procedure that was both too drastic as well as unnecessary. In younger, hyper-suggestible patients, the procedure can precipitate extremely aggressive behavior. In addition, it often doesn't work, because the mushrooms tend to clog the pumping apparatus.

Therefore, panic reactions after ingestion *of Psilocybe semilanceata is* a condition that, in some cases, may be aggravated or even induced by improper treatment of the patient at hospitals and clinics. After evaluation of the statistics on *Psilocybe semilanceata* usage in Great Britain, J. Francis and V.S.G. Murray emphasize that there has not been a single fatality among some 318 poisoning cases - in fact, no severe somatic symptoms were noted, nor have there been incidents of misidentification of the mushroom species. According to the authors, intoxication can be a quite unpleasant experience for the individual. Panic reactions pose the only significant hazard, which may endanger the individuals as well as their surroundings for the duration of the mushrooms' effects.

As an ideal treatment, they proposed that patients be moved to a darkened, beautiful room, and that they be watched until the effects have subsided. If necessary, tranquilizers such as diazepam should be administered.

R. Watling mentions a non-fatal case in Scotland, where *Inocybe geophylla (Sow. & Fr.)* Kumm., a mescaline-containing species, had been mistaken for the *Psilocybe* species.

In the 1980s, *Psilocybe semilanceata* was named as the mushroom species that caused by far the largest number of intoxications in Great Britain. Today, usage of this psychotropic species in that country is not quite as popular anymore as it was 10 years ago. Also, mushroom eaters are no longer prosecuted.

By comparison, a short report by a medical student from Manchester was not convincing. The report claimed that a 24-year old patient suffered from severe depression with somatic side effects for three months ("persistent psychiatric symptoms") and that these symptoms had been induced by ingestion of *Psilocybe semilanceata.* At the time, the patient was experiencing personal stress and had also taken other substances as well. Despite the wide distribution of psychoactive mushrooms around the world, there have been no reports of similar episodes.

The usage of *Psilocybe semilanceata* in Norway was first described during the fall of 1977, in Sandnes, near the Rogaland area. Up to that time, the Norwegian literature had depicted *Psilocybe semilanceata* as merely a small, inedible mushroom known to grow in grass interspersed with other, similar, species. Apparently, the experiences in England and the United States inspired the use of these mushrooms in Norway, as well as in other European countries. However, it is also possible that a report published in 1976 about the discovery of psilocybin in Norwegian collections contributed to subsequent usage of the mushrooms.

Knowledge about the mushrooms spread quickly around Norway, especially in the fjord areas, were the species fruits most abundantly. Daily and weekly papers as well as underground magazines dealt with the mushrooms at length. Only a small number of panic reactions were known to have occurred in Norway, with some individuals requiring temporary clinical attention. Nonetheless, in December 1981, the mushroom species was classified under Norwegian narcotics law as an "absolutely forbidden substance". The same classification applies to the potentially dangerously addictive drugs of the heroine type, as well as to the pure hallucinogens, such as LSD, mescaline and psilocybin, all of which are pharmacologically completely different from any of the heroine-type drugs. By contrast, Figure 57 illustrates that other European nations have attitudes similar to those found in British Columbia, which form the basis for my own analytical work with mushroom materials.

Compared to Norway, there is less information about usage of *Psilocybe semilanceata* from other countries. The year 1981 has been named as the starting date of usage in Finland; by 1984, there had only been one patient who required medical attention.

There are additional countries where the mushrooms are being used and collected, more or less sporadically: The Netherlands, Austria,

Denmark, Sweden, Belgium, Germany, Switzerland, and recently Russia near the St. Petersburg area. The mushrooms have even been found in Siberia. In some areas, where the mushrooms thrive in abundance, a more comprehensive mode of usage can be observed, without attracting much additional attention over a longer period of time.

Costly measures, such as the deployment of helicopters over pastures in the Jura Mountains of Switzerland to flush out mushroom collectors have rarely been used and were quickly abandoned.

Switzerland is another country where *Psilocybe cubensis is* being cultivated and used without attracting much attention. Below is an account provided by a Swiss friend about his first ever experience with this species:

Intense, kaleidoscope-like colors are being generated. I begin to dive in and out of other realities, followed by the painful loss of ego, death and life. Suddenly I find myself inside a wooden box. My body is a black mass full of low-level pain. I have the black plague. I was put inside the box, because I was thought to be dead, but I am still alive. I am being carried to and placed on top of cart so that I can be transported to be burned. Few others are being given such a box. At first I am in despair, but then I know that the end is near, anyway. Death is a liberation for me. I remember: I see my house in the city center of Metz, where I used to live until now. Then came the plague. My years of selfish dedication of helping sick, degenerate, stinking, hungry and dying people.

I provide comfort and companionship, as well as medication that remains ineffective. I continuously make house calls, there is no end in sight. I become ill myself. At first I deny this fact, but now I am inside this wooden box, in a state of semi-consciousness. I know that the end is here.

I know that I am a physician named Claudius Vinzen and that the year is 1427.

I wake up in the reality of winter, 1990. Metz, where is Metz? Later on, I locate the city on a map of France and until this day, I have been trying to verify if this physician lived there during the Middle Ages. I am reminded of my long years of professional work with criminal and drug-addicted youngsters. I sense the common elements of these two realities (karma?), the sacrifices of selfless helping.

Such deeply moving experiences do not appear to be unusual (compare to reports of experiences with *Psilocybe semilanceata* in Chapter 3.1) and should always be studied in all seriousness.

Only France seems to engage in elaborate activities designed to locate collectors of psychotropic mushrooms. Despite its grand mycological traditions, France is a country that has a rather absurd prohibition against the exhibition of *Psilocybe* and *Stropharia* species (European *Stropharia* species do not produce psilocybin) at scientific conventions. As a consequence, French mycologists have been avoiding the use of the genus *Psilocybe.* Nowadays, at mycological conventions, *Psilocybes* are exhibited under the old name of *Geophila (Quelet),* which appears to have gotten around the problem of breaking the law.

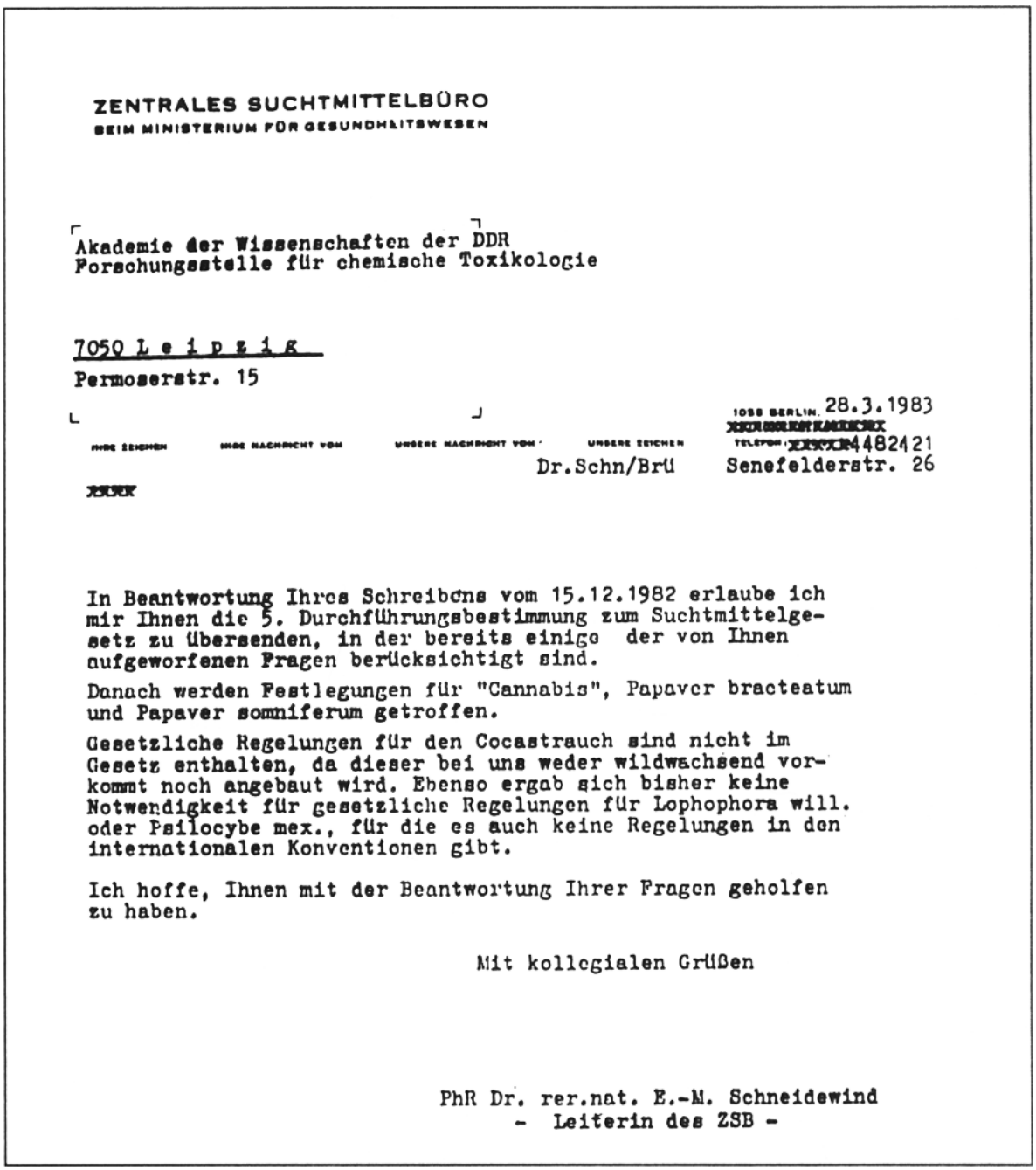
According to my personal communications with mycologists, the usage of *Psilocybe semilanceata* in Italy began in about 1980/1981 and has been rising steadily since then. At the same time, there have been no clinically relevant cases, nor any legislative action on the matter. Towards the late 1980s, usage of psychoactive *Psilocybe* species began in the former Czechoslovakia, for instance, around the region of Brno. It appears that *Psilocybe bohemica is* used more often in this country than *Psilocybe semilanceata,* as the former species is quite common there.

Very little is known about European usage of mushroom species from other genera. In the mid-1980s, Spanish youngsters near Barcelona were observed using *Panaeolus* mushrooms.

The well-known booklet authored by Oss and Oeric about the cultivation of *Psilocybe cubensis* has been translated into several European languages and published in different countries. It is almost certain that the book is being used as a cultivation guide in Europe, however, there are no available data about the success rate of these experiments. In many cases, commonly occurring contaminants probably prevent fruiting of this subtropical species on rye substrate.

I won't risk making predictions about the extent of future usage of indigenous European psychoactive mushroom species, nor am I able to predict which species may or may not gain in

popularity. However, it is possible to speculate that the increased geographic distribution of species such as *Inocybe aeruginascens* and *Psilocybe cyanescens* may lead to more unintentional intoxications, which, in turn, may result in creating a generally deeper knowledge base about the attributes of these mushrooms.



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XXXX

In Beantwortung Ihres Schreibens vom 15.12.1982 erlaube ich mir Ihnen die 5. Durchführungsbestimmung zum Suchtmittelgesetz zu übersenden, in der bereits einige der von Ihnen aufgeworfenen Fragen berücksichtigt sind.

Danach werden Festlegungen für "Cannabis", Papaver bracteatum und Papaver somniferum getroffen.

Gesetzliche Regelungen für den Cocastrauch sind nicht im Gesetz enthalten, da dieser bei uns weder wildwachsend vorkommt noch angebaut wird. Ebenso ergab sich bisher keine Notwendigkeit für gesetzliche Regelungen für Lophophora will. oder Psilocybe mex., für die es auch keine Regelungen in den internationalen Konventionen gibt.

Ich hoffe, Ihnen mit der Beantwortung Ihrer Fragen geholfen zu haben.

Mit kollegialen Grüßen

PhR Dr. rer.nat. E.-M. Schneidewind
- Leiterin des ZSB -

Figure 57 - A letter from the "Central Bureau of Substance Abuse" in the former East Germany, detailing some legal restrictions on psychoactive plants. At the time (1983), *Psilocybe mexicana* was not a controlled substance and no restrictions applied to its use.

Figure 58 - Woodcut entitled "Cooking Witches" by Baldung Grien (1514). Such cultural practices undoubtedly included familiarity with psychotropic mushrooms, even though such knowledge was considered pagan at the time. The practice of "witchcraft" was maligned and accused witches were persecuted, tortured and executed, as the Christian Inquisition was desperate to suppress pagan beliefs and wisdom.

CHAPTER 7.5

JAPANESE EXPERIMENTATION

Mushroom species containing psilocybin are also found in Japan. Tales about the infamous "Laughing Mushroom" date as far back as the Middle Ages. An account from the 11th century became famous:

Several lumberjacks from Kyoto got lost in the woods for reasons that remain unknown. Suddenly they encountered four or five Buddhist nuns, whose behavior did not at all conform to expectations: instead of immersing themselves into their inner selves in a quiet quest for Nirvana, the search for Absolute Nothingness, these daughters of Buddha were found dancing and laughing. It turned out that the nuns had also gotten lost in the woods and dealt with their hunger by eating some delicious mushrooms. The faithful nuns soon discovered, however, that they could not stop dancing and laughing. The lumberjacks's stomachs, in the meantime, had also begun to growl and, thinking that what was good for the nuns was good enough for them, the lumberjacks ate some of the mushrooms as well. Soon after, they also succumbed to overwhelming fits of laughter and the urge to dance.... The linguistic moral of the story: since that time, the mushrooms in question have been referred to in Japanese as

- "maitake" (Dancing Mushrooms)
and later on
- "waraitake" (Laughing Mushrooms).

For a long time, the species thought to be responsible for these symptoms were identified in the mycological literature as *Panaeolus papilionaceus* and as *Gymnopilus spectabilis* ("giant laughing mushroom"). However, today we know that the former is a species from Europe and North America which does not contain any psychoactive substances, while even Japanese authors have been unable, since 1980, to confirm the existence of psilocybin and its derivatives in the latter *Gymnopilus* species. Only inactive substances have been found in *Gymnopilus spectabilis*.

In Japan, the investigation of these mushrooms has a long tradition: There is evidence that mushrooms have been cultivated in Japan for no less than 2,000 years, by collecting naturally grown mycelia of *Lentinus edodes (Berk.) Singer* and transferring onto pieces of wood selected to serve as new substrates.

Incidentally, literary sources from China also attest to knowledge about mushrooms from that country, where such mushrooms were said to be the cause of a (temporary) "disease of dry laughter".

Still, the reports about an irresistible urge to dance constitutes a rather unusual effect of psilocybin, from our current point of view. While psilocybin is initially known to cause fits of laughter, this phase is generally followed by a state of relaxation and a drop in levels of physical activity. It is likely that, in this case, medieval Japanese mentality was a cultural factor that modified the specific expression of an altered state of consciousness.

Aside from the two disputed mushroom species mentioned above, several psychoactive *Psilocybe* species can be found in Japan. There are several known cases of accidental ingestion that occurred during the 20th century, resulting in psilocybin syndromes without inducing fits of dancing.

For example, in 1932, S. Imai described cases of intoxications from 1929 and 1931 which involved his newly classified species *Stropharia caerulescens.* Later on, the species was named *Stropharia venenata Imai,* which grows on top of wood and dung. Today, it is being classified within the genus *Psilocybe* as a close relative of *Psilocybe cubensis.*

Imai mentions an event that occurred on June 21, 1929: *A 43-year-old woman collected about 13 oz. of a type of mushroom that she erroneously thought to be honey mushrooms (Armillaria mellea). The following day, she prepared a tasty mushroom meal and served it to her family. As family members began to notice the effects, they immediately went to see a doctor, who determined that the woman was experiencing the*

most potent effects: Her stomach was pumped without delay and laxatives were administered, but she still had muscle twitches, followed by hallucinations and a comatose (?) state. The son, who had eaten the soup only, experienced hallucinations as well, because the cooking process had served to extract the water-soluble compounds from the mushrooms.

No Danger from *Psilocybes* in Japan

Unfortunately, Singer and Smith mistakenly cited these incidents in their (1958) monograph about the *Psilocybe* genus as examples of the mushrooms species' fatal effects. For that reason, this species was unjustly branded for decades in the literature as a highly dangerous poisonous mushroom.

There are other psychoactive mushroom species that grow in Japan, such as the bluing species *Psilocybe subcaerulipes Hongo* and *Psilocybe argentipes Yokoyama.* These species also caused intoxications in three people, who mistook the mushrooms for the honey mushroom. These cases brought about the isolation of psilocybin in crystalline form from dried fruiting bodies of the species, as well as recognition of the species' wide area of distribution. In 1973, Yokoyama published the results from systematic experimentation with *Psilocybe argentipes. No* "urge to dance" was noted in these investigations as well. Below are some excerpts from his research protocols:

J.H. (a 24-year-old male) ingested four cooked mushrooms at night, after a meal (!), and then ate another three fresh mushrooms 30 minutes later. This was followed by regurgitation, and 45 minutes later, he started to sweat profusely all over his head and body. His pulse rate and breathing were accelerated, but slowed down later on. He laid down and experienced visual hallucinations, which caused him to panic and to run a distance of about 1,200 ft. to consult the nearest doctor. The physician noted widely dilated pupils, and proceeded to have the patient's stomach pumped and then prescribed laxatives. Three hours later, the abnormal state had largely subsided; by the next morning, there was no evidence of any other side effects.

M.K. (a 22-year-old male) ate just one fresh mushroom, which had no effects at all.

K .Y. (a 31-year-old male) ate five mushrooms. Regurgitation occurred 30 minutes after ingestion, followed by sweating around the head and body; his extremities appeared to be slightly paralyzed. This paralysis persisted for another three hours. During this time, the subject had great difficulties handling a pen for writing, his mood was depressed and he experienced hallucinations, such as colorful lights flooding down from the sky. By the following morning, all of these effects had dissipated. The fresh fruiting bodies were bitter, a taste that disappeared after the mushrooms had been cooked in water.

The above experiments are rather amateurish, and the descriptions of results are heavily influenced by a simplistic perspective which assumes that the mushrooms's pharmacological effects proceed along a single, narrow track. Still, these accounts demonstrate that comparable dosages of Japanese mushroom species have psychotropic effects similar to those caused by *Psilocybe* species found on other continents.

Much work still remains to be done in the areas of phytochemistry and taxonomy before the body of knowledge about psychotropic mushroom species in Japan can grow to become adequate. The geographic distribution and ingredients of the Japanese *Panaeolus* species must also be studied further. For instance, *Panaeolus subbalteatus is* one of the species that are growing on several Japanese islands today.

CHAPTER 7.6

INTOXICATIONS AND THE OLDEST KNOWN MUSHROOM CULT IN AFRICA

So far, the mycoflora of the African continent has been studied only peripherally and remains largely unknown. During the late 1980s, Italian mycologist G. Samorini and Terence McKenna, working independently, found evidence for the oldest known mushroom cult in Africa. Their discoveries were not just sensational, but most surprising as well. On the other hand, it really shouldn't come as a surprise that the oldest traces of human contact with mushrooms were found on the very continent known as the cradle of humanity.

10,000 Years Old

From 9,000 to 7,000 years ago, the area of the Sahara - between Tassili (Southern Algeria), Acacus (Libya) and Ennedi (Chad) - was populated by human beings who created magnificent rock drawings, a pictorial legacy that preserved for posterity impressive images of everyday life. These pictures tell about a time when the Sahara was still a blooming garden, a time when no one even suspected that processes of erosion and desolation, starting about 3,500 B.C., would turn the area into a desert quite hostile to human life.

The rock drawings date from as far back as 10,000 B.C. up to the present. Among the drawings from the Stone Age (7,000-5,000 B.C.), there are those described as typical of the so-called "round head phase". They include pictures of pasture animals as well as evergreen and deciduous trees. On top of a Sahara plateau, at an altitude of 6,500 ft., there exist pictures of mythical beings with anthropomorphic and zoomorphic attributes which are reminiscent of early Mexican images: many scenes depict tiny horned dancers alongside mushrooms. Deities with masks and horns are seen holding mushrooms in their hands; sometimes the mushrooms are shown attached directly to body parts. In addition, those Stone Age artists created images of anthropomorphic beings with mushroom-like heads. There are many other indications pointing toward the existence of a comprehensive mushroom cult.

Among the most striking renditions at Tin-Tazarift, Tassili District (Algeria) is a picture of masked anthropomorphic beings engaged in ecstatic dancing. (See Figure 5, p. 8). This figure, "Anthropomorphic Beings Engaged in Mushroom Dance", includes several dashed lines, which are most interesting, because they connect the mushroom with the center of the head. At the same time, these lines represent a flow of energy, maybe even the mushrooms' influence on the human soul. This picture is clearly indicative of psychotropic mushroom use. It seems quite remarkable that, as early as 9,000 - 7,000 years ago, the head was apparently considered to be the seat of consciousness. By contrast, four or five millennia later, during the European era of classical antiquity, the brain's role was merely thought to be similar to that of a kind of cooler. Other rock drawings also depict mushrooms as being mythologically linked with fish.

These images, then, furnish powerful evidence for the usage of psychoactive mushrooms within a mystical-religious frame-work. The rock drawings consistently show two kinds of mushroom shapes: one of them resembles *Psilocybe semilanceata,* in that the caps are drawn with an acute umbo on top, while the other shape represents larger mushrooms with a habitus much like that of the *Amanita* or *Stropharia* species.

Despite their age, the rock drawings' colors have retained brilliant hues. Pictures of mushrooms were drawn in white as well as several shades of ochre. Also, a few mushrooms were drawn in blue colors. While this is the exception, it may well be a representation of the so-called bluing phenomenon.

In Nature, these colors are associated with the bluing *Psilocybe* and *Panaeolus* species. These mushrooms could have grown on several

substrates, such as fallen twigs and raw compost, grounds littered with the remains from evergreen and deciduous trees or dung left behind by pasture animals. Among the mushroom species that may have grown in the area thousands of years ago, the most likely candidates are relatives of *Psilocybe cubensis* and *Panaeolus cyanescens* (dung-inhabiting species), *Psilocybe semilanceata* (a nitrophilic species) as well as *Psilocybe cyanescens,* a species that grows on top of raw compost.

Considering the impressive nature of existing historic evidence, the obvious question would seem to be whether any of these species can currently be found in Africa, where the cradle of mankind is located.

African Species Related to *Psilocybe Cyanescens?*

Interestingly, on October 24, 1912, R. Maire first collected several specimens of bluing, dark-spored mushrooms which he found growing on raw compost underneath some cedar trees in Algeria, at Chrea Pass near the city of Blida south of Algiers. He collected additional specimens every year up until 1926 and published his findings in 1928, naming the species *Hypholoma cyanescens nov. spec.*.

Later on, G. Malencon classified a number of similar specimens from his own samples collected in the Central Atlas Mountains (Morocco) as belonging to this species. In 1973, Singer then classified the species as *Psilocybe mairei Sing.* Krieglsteiner, however, considered this species to be identical with *Psilocybe cyanescens Wakefield,* as found in Europe. Thus, bluing *Psilocybe* species can still be found in Africa today.

In his monograph on *Panaeolus* mushrooms from the 1960's, Ola'h mentions two *Panaeolus* species that are strongly psychoactive:

- *Panaeolus africanus Ola'h* and
- *Panaeolus tropicales Ola'h*

There are also accounts from Africa about typical hallucinatory intoxications, caused by mistaken identification of a yellow *Stropharia* species as a culinary mushroom. In 1945, E.R. Cullinan and D. Henry described 22 cases in Nairobi, which occurred in July of that same year.

The symptoms started one hour after ingestion of the mushrooms, peaked within three hours and then persisted for 24 to 48 (?) hours. Symptoms consisted of emotional imbalance, fits of mirthful and irresponsible laughter alternating with depressive moods, during which patients felt they wanted to die. Patients were unable to sleep, due to nightmarish feelings that descended when they closed their eyes... They remained conscious throughout the experience and their speech, while somewhat uncontrolled, was rational.

In 1957, A.D. Charters reported additional cases of intoxication from Nairobi: *On May 18, 1949, a man and his wife - both Europeans who resided in Nakuru, ate generous portions of mushrooms for lunch. Within 30 minutes, both of them developed mental symptoms, along with pupil dilation and a tingling sensation in the fingers.*

The man experienced visions of pink colors and a sense of euphoria in association with delusions. He felt that he was passing into the next life and he could see his own body. He stated that he realized "we are in the process of working toward our next life ".

His wife also reported delusions, and she felt that she was inside the tube that was part of the apparatus used for pumping her stomach at the time. She believed that she was going to die and she was afraid of death. She had laughing fits and felt sensations that alternated between happiness and depression. Both patients had their stomachs pumped and recovered completely within six hours.

Given sufficiently wet climate conditions, *Psilocybe cubensis* can often be found in other parts of the world growing on pastures in areas located up to 30° north as well as south of the equator. Therefore, it is likely that the yellow *Stropharia* species from the Highlands of Kenya may actually have been *Psilocybe cubensis* mushrooms or at least a close relative of this species.

In January 1994, M. Smith and myself were collaborating in South Africa, where we discovered a bluing *Psilocybe* species in Natal Province. It was the first psychotropic *Psilocybe* species ever found in the area. This species is generally withish in color and does not have an

annular ring. The mushrooms are comparable in size to *Psilocybe cubensis,* but do not grow directly on top of dung in cow pastures. Having been compared with samples of known *Psilocybe* species, the new species is currently being published under the name *Psilocybe natalensis Gartz, Reid, Ecker & Smith.*

The mushroom samples and reports of intoxications described in this chapter indicate that psychoactive species do occur in Africa, which, in turn, supports the hypothesis of an ancient mushroom cult on the African continent. However, additional work is needed with respect to the African species, including their areas of distribution, their taxonomic classification and the essence of their active ingredients.

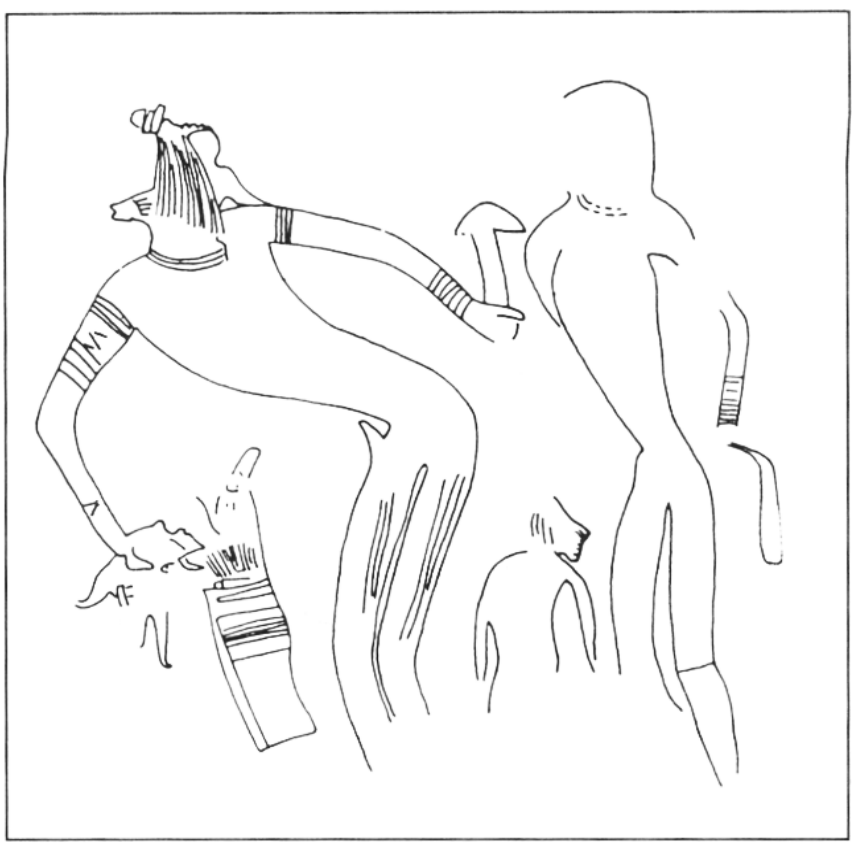

Figure 59 - Outline of a rock drawing from Tassili, Algeria (ca. 7,000 B.C.). The figure on the left clearly is holding a mushroom-shaped object.

CHAPTER 7.7

USAGE IN SOUTH EAST ASIA AND THE SOUTH PACIFIC ISLANDS

Since the late 1960s, the custom of using psilocybin-containing mushrooms has been evolving in various countries across Asia and the Pacific Islands. However, there is no conclusive evidence indicating that mushroom usage was endemic among native cultures prior to the discovery of the Mexican species. Most likely, global tourism has been the most significant factor behind increasing knowledge about relevant mushroom species among the populations of these countries, especially after searches for strongly bluing gilled mushrooms were successful. These mushrooms, most notably those found growing on pasture land, strongly resembled similar species from other continents.

Neo-Mycoflora

Western amateur mycologists helped disseminate information about these species and published articles on the mushrooms in various publications of their home countries. However, little or no efforts were made to identify and describe specific mushrooms species found growing in Asia and the South Pacific Islands. There have also been no research efforts to investigate the overall mycoflora in this part of the world. Thus, during the 1970s, a group of teenagers in Samoa discovered the psychoactive effects of *Panaeolus cyanescens.* At first, the police took measures to suppress the practice. But persecution by law enforcement agencies was halted when it became apparent that ingestion of the mushrooms did not pose a significant health risk. According to Cox, the teenagers' parents considered their children's mushroom experience "a foolish, but totally harmless episode and a part of normal teenage development". In light of such a reasonable frame of reference, the historic label "fool's mushrooms" (Chapter 2) immediately comes to mind.

By contrast, customs of psychoactive mushroom usage in New Zealand evolved around the same species found in Australia, with criminal penalties also modeled after Australian measures of law enforcement. However, in contrast to *Psilocybe semilanceata* and *Panaeolus cyanescens, Psilocybe cubensis is* not a species native to New Zealand, and all psychoactive species are generally referred to as "magic mushrooms".

To date, we do not know about all those geographic regions where the discovery of bluing mushroom species was an event that did not attract much attention, yet contributed to the mushrooms's growing popularity and an ever-increasing number of "silent" users. Scientific-mycological investigations of a small number of samples provided clues to the identification of psychoactive species relevant in this context: the two dung-inhabiting species *Psilocybe cubensis* and *Panaeolus cyanescens,* as well as *Panaeolus tropicales,* a close relative of the latter species. In most cases, the differentiation of the two *Panaeolus* species is an extremely difficult task.

Panaeolus cyanescens Omelettes

During the seventies and eighties, the mushroom restaurants of Bali became quite famous, since interested tourists could order mushroom omelettes made with *Panaeolus cyanescens* - house specialties, and all completely legal to boot. At first, local children collected the mushrooms needed to prepare the dishes. In response to increasing demand for this culinary specialty, however, commercial cultivation of the *Panaeolus* species began, using the method of transferring dung with naturally-grown mycelia onto fresh buffalo manure.

Apparently, no major complications ensued, and this type of mushroom usage remained unchallenged for a long time. In Bali, ingestion of mushrooms has been limited, for the most part, to visiting tourists. In 1992, a German tourist reported that, if anything, the number of restaurants had increased compared to the 1980s. The number of restaurant patrons, however,

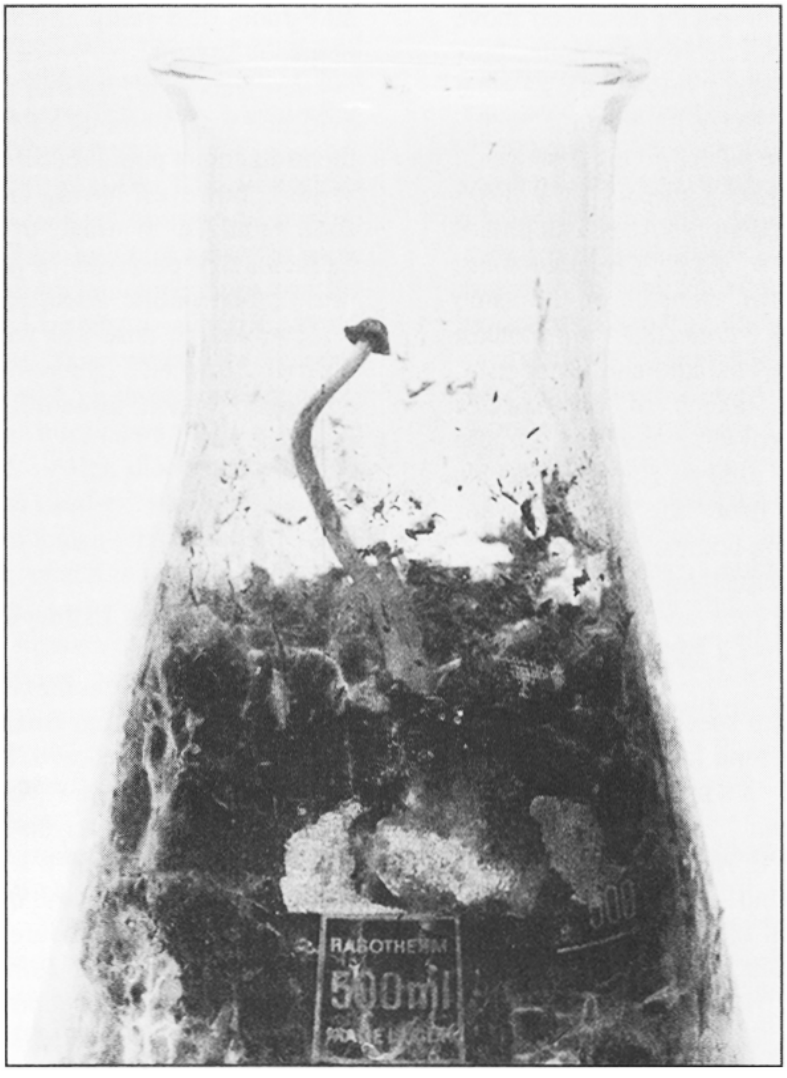

Figure 60 - *Psilocybe samuiensis* on a mixture of rye and horse dung

appeared to have decreased, indicating an increasing familiarity with psychoactive mushrooms species in the tourists's countries of origin.

Similar stories about mushroom specialties exclusively prepared for tourists have also been reported from Sumatra, Java and The Philippines.

Those mushroom species described above are based on samples collected from islands; thus, it is quite logical to expect finding those same species growing on the Asian mainland as well. Soon after Earle published his description of *Stropharia (Psilocybe) cubensis* in a 1906 edition of a Cuban agriculture journal, Patouillard proposed the species name *Naematoloma caerulescens* for his own samples of the same species, which were collected in Tonkin (Vietnam) in 1907. In Thailand and Cambodia, Heim found fruiting bodies of the species *Psilocybe cubensis,* providing the first sample from outside of Mexico used by Hofmann and his collaborators to confirm the presence of psilocybin in the fruiting bodies.

Such positive results inspired the proposal that psychoactive *Psilocybe* and related species thrive on all continents, a hypothesis that has been fully confirmed.

Other mushroom species from the genus *Panaeolus* have been found in mainland Asia as well. For example, Ola'h's monograph describes a bluing mushroom named *Panaeolus cambodginiensis Ola'h & Heim,* a species - as its name suggests - found only in Cambodia. According to Ola'h, all of the species's fruiting bodies contain psilocybin.

Monsoon Climate, Manure and Water Buffaloes

In 1981, Schroeder reported the results of his mycological field work conducted in Nepal during 1978 and 1979, where his research efforts established that mushrooms of the *Psilocybe* species are wide-spread throughout the area. Guzman proposed that these species can quite possibly be classified as *Psilocybe cubensis* and *Psilocybe subcubensis Guzman.* Macroscopically, the latter species is very similar to the subtropical *Psilocybe cubensis* species, but its spores are comparatively smaller and its habitat limited to tropical regions.

The mushrooms primarily grow in valley areas with monsoon climate conditions, at altitudes of about 3,000 ft. on substrates of partially decomposed cow manure as well as on water buffalo dung. While the species fruits all year round, it does so most abundantly in May and June, the rainy months that precede the monsoon season.

Nepal is another country where no evidence was found of any mushroom usage by the indigenous population. Mycophilic Western visitors, however, having discovered the species, soon indulged in usage of the mushrooms for hallucinatory purposes, a practice that failed to draw much public attention. It appears that a relatively large dose was required to achieve the desired effects, since several individuals consumed forty or more of the fleshy mushrooms at a time.

"Soma": A Psilocybian Species?

Within the context of discovering this species, Schroeder and Guzman proposed a most interesting hypothesis. They suggested that "soma", the substance revered as a deity by the mysterious, ancient Aryan civilization, who are said to have developed a soma cult, did not, in fact, refer to the fly agaric mushroom, as initially proposed by Wasson. More likely, soma was the name of a psychedelic *Psilocybe* species, based on its spectacular psychotropic effects and the mushroom's geographic distribution pattern.

An article authored by J.W. Allen and M.D. Merlin concludes that currently Thailand is the country with the largest consumption of psychoactive mushrooms.

In several areas across Thailand, tourists can find menus offering mushrooms prepared as part of omelettes, soups, teas, pizzas or juices. Allen specifically studied patterns of usage on the two islands of Koh Samui and Koh Pha-ngan. Previously, sporadic reports from other islands off the Thai coast contained descriptions of similar practices there. In January 1990, Allen also confirmed usage of the mushrooms in the northern areas of Thailand.

German Tourist Boom

On Koh Samui and Koh Pha-ngan, the mushroom dishes are enjoyed primarily by German tourists. Along with a few other foreigners, some Thai teenagers use the mushrooms as well, sometimes even attempting to smoke them in a bamboo pipe. As a salt-like chemical compound, psilocybin requires temperatures of about 200°C for it to melt and partially break down without sublimation, so that a tobacco pipe will not be effective in achieving the desired psychoactive effects.

During the fall of 1988, Thai authorities distributed warning leaflets at tourist centers, providing a detailed description of a bizarre panic reaction experienced by an Australian tourist, who was hospitalized briefly as a result. Allen thoroughly analyzed this event by seeking additional information about the circumstances of this case, including interviews with all other individuals involved. Allen discovered that the Australian visitor had used excessive amounts of various pharmaceuticals, including highly addictive substances, which is why he eventually required hospitalization.

Finally, in January 1989, this incident was central to justifying passage of a law that prohibits usage of psychoactive mushrooms ("hed keequai" in local language), with harsh penalties provided for non-compliance. Until that time, many restaurants posted signs advertising the various types of mushroom dishes on their menus. But mushroom usage continued despite passage of the law. Specific species still being used were identified as *Psilocybe cubensis, Psilocybe subcubensis* and *Panaeolus cyanescens.* It is unknown if a tourist in Thailand has ever been sentenced for usage or possession of mushrooms. In addition to the collection of fruiting bodies growing naturally on buffalo dung, Thai as well as German residents on Koh Samui and Koh Pha-ngan began to cultivate the mushrooms, outdoors and inside houses. In accordance with the "natural cultivation" approach, rice debris was added to fresh manure and mixed with dung already permeated by mycelia. After prohibition, mushroom cultivation continued at hard-to-reach wilderness locations.

Moreover, Allen found evidence that some restaurants temporarily served dishes made from regular table mushrooms apparently spiked with a synthetic hallucinogen (LSD?) whose effects lasted much longer than those of psilocybin. This dangerous practice caused unexpected reactions with effects lasting for up to 10 hours. Some consumers experienced dysphoric side effects which persisted for as long as several days. One individual developed an aversion against all kinds of mushroom dishes for several months.

As in Mexico during the sixties, a large variety of mushroom images and products are marketed commercially in Thailand these days. Among merchandise offered for sale there are hand-painted and mass-produced T-Shirts (see Figure 56, p. 78) with pictures of *Panaeolus cyanescens* and *Psilocybe subcubensis,* shown together as well as separately, not to mention postcards, posters, lighters and key rings, all featuring mushroom-motif decorations. Allen reported that such goods are available in both Northern and Southern Thailand.

In coming years, we can well expect a wealth of new discoveries and insights into the ethnopharmacology, taxonomy and natural chemistry of Asia's mycoflora.

Not surprisingly, another new mushroom species was discovered in Thailand in August, 1991 and named *Psilocybe samuiensis Guzman, Bandala & Allen* (see Figure 60, p. 99). The species is similar in appearance to *Psilocybe semilanceata,* but the fruiting bodies do not contain baeocystin. *Psilocybe samuiensis is* a bluing species that grows on fertilized soil, but not directly on top of dung. We successfully cultivated this species on a mixture of rye, horse dung and water (2:1:2), but found that we needed to add a casing layer consisting of peat and chalk (2:1).

CHAPTER 8

SOME COMMENTS ON EFFECTS OF MUSHROOMS FROM THE CATEGORY PHANTASTICA

Extensive animal research efforts during the 1950s furnished evidence that both psilocybin and psilocin are alkaloids of negligible acute toxicity. Specifically, the dosage of psilocybin that caused death in 50% of the experimental mice (LD 50) was determined to be 280 mg/kg body weight. By comparison, noticeable effects in humans generally occur at dosages as low as 0.02 mg/kg.

Animal tests showed that, on average, psilocybin was a substance only half as toxic as mescaline, and at the same time, turned out to be 50 times more potent as a psychoactive substance. For example, up to 2 g of mescaline were being administered with no dangerous side effects, while the usual dose of psilocybin ranged from 3 to 30 mg as part of psychological testing and psychotherapy sessions.

As is the case with other psychotropic substances, human beings most likely have a more sensitive reaction in response to psilocybin than mice do. Still, the range of safety in controlled experiments comes to several hundred times the amount of the active dosage. The same goes for the consumption of mushroom material, since psilocybin concentrations in mushrooms can vary up to a factor of 10. Consequently, J. Ott speculated that adults would need to eat their own body weight in fresh mushrooms, in order to finally reach the dosage limit of lethal toxicity. Despite the hundreds of thousands of voluntary self-experiments taking place every year in the U.S. alone, no fatalities caused by magic mushrooms have ever occurred there. Small children, however, have abnormal reactions to psilocybin, such as loss of consciousness, cramps and danger of death.

It was in the fall of 1960, that a child from Milwaukee, Oregon, picked several mushrooms from grassy soil below a cluster of conifers. Having eaten the mushrooms, the child experienced cramps and a high fever. Similar to a condition described as "status epilepticus ", the symptoms were treated by medications, with limited success. The child died within three days.

The mushroom sample involved in this incident was identified as *Psilocybe baeocystis.* P. Stamets, however, contested this finding, claiming the species had been misidentified. He referred to a publication about the incident that included a picture of the mushrooms, which, according to Stamets, shows a sample of *Psilocybe cyanescens.* This species is wellknown as exceptionally potent, due to high levels of psilocybin and psilocin. Still, we cannot determine whether toxic concentrations of alkaloids were the cause of death, or whether ingestion of the alkaloids triggered a latent case of epilepsy in the form of an acute episode that could not be treated or controlled. If a similar incident happened nowadays, fatal outcomes could be easily prevented, since the last three decades of progress in pharmaceutical research included the discovery of new drugs capable of aborting convulsive episodes.

Due to publicity generated by the unfortunate accident in 1960, two alkaloids (baeocystin and norbaeocystin) first isolated from *Psilocybe baeocystis,* at times acquired reputations of being extremely poisonous as well as strongly psychoactive. Both claims, however, are wrong and unsubstantiated. Specifically, both baeocystin and norbaeocystin are present in other mushroom species, such as *Psilocybe semilanceata,* and at generally higher levels compared to the alkaloid content of *Psilocybe baeocystis.*

Biochemical research efforts accelerated and large numbers of studies were conducted, primarily with LSD. These investigators sought to discover the receptor binding sites for hallucinogenic compounds in the brain and to understand the mechanisms underlying the genesis of psychedelic visions. Today, we still lack a sound theoretical framework able to explain the relationship between chemical compounds and the manifestation of their

psychoactivity. Even though basic research is certainly important, its methods, unfortunately, are often a function of a rather one-sided pharmacological approach to investigating the effects of psilocybin, LSD and mescaline - an approach that is, in fact, too narrow to address the remarkably unusual nature of these substances and their effects.

Misunderstandings between pharmacologists and toxicologists on the one hand and psychiatrists and psychologists on the other can often be traced all the way back to the 1950's, creating a legacy of disputes and arguments that have yet to be resolved. S. Grof undertook the tedious task of analyzing 5,000 experimental LSD protocols in an effort to isolate "absolute" symptoms that are reported or occur all of the time. His results were negative. According to Grof, hallucinogenic substances are non-specific triggers causing a sequence of altered states of consciousness, which do not fit the syndrome labeled "toxic psychosis". Rather, it is the individual's personality, along with the experimental setting that significantly shape the nature of the psychedelic experience. This view is shared by a majority of experts with considerable experience in conducting psychedelics-assisted psychotherapy. Even "real" somatic symptoms, such as nausea or vomiting, can often be controlled through psychological intervention techniques administered by trained professionals.

A Plethora of Names

The broad range of possible experiences inspired the use of labels other than "hallucinogens", with widely differing semantic connotations: entheogens, psychedelics, illusionogens, psycholytics, psychomimetics, psychodysleptica, psychoemetics and others.

"Phantastica" (Lewin) is the oldest label ever used to describe this class of substances. This term successfully evokes dream-like, fanciful aspects of the experience, as well as the potential for euphoric and dysphoric emotional overtones. More recent terminology often says more about semantic biases of those who use the labels than about any factual, objective characteristics of the alkaloids they refer to. Accordingly, official anti-drug propaganda since the 1960's has disparaged "psychedelics" as excessively glamorous and too positive a label, as the term was popular among Timothy Leary's fans and supporters.

When used in low doses or for the first time, these substances are most likely to bring about a kind of magical transformation of surroundings, with a heightened ability to perceive subtle differences along the color spectrum - effects an individual often takes in with a great sense of wonder and awe. Based on these types of experiences, the label "psychoesthetica" has been used as well.

During the 1950's, those experiments of a purely pharmacological nature revealed that, within a specific low dosage range, the effects of psilocybin and LSD were largely similar, except for the shorter duration of the psilocybin experience. That is why there are numerous comparisons in the literature of 10 mg of psilocybin with 100 ug of LSD as equivalent dosages.

There are several authors, however, who focus on the more visionary and metaphysical nature of the psilocybin experience compared to other hallucinogenic substances. A. Hofmann conducted self-experiments with both substances and found the altered state of consciousness induced by psilocybin to be both deeper and somewhat gloomier than those produced by LSD.

Other investigators have portrayed psilocybin as "friendlier" - a substance that is not as fierce as LSD in exposing possible traumas hidden within the subconscious mind (see Chapter 3.2). Such differences in comparative evaluations of psilocybin and LSD are likely linked to a variety of factors, such as dosage differences, research protocols less than comprehensive and exhaustive in scope, as well as personality and environmental variables.

LSD "Flashbacks"

R. Fischer conducted a series of experiments designed to study the effects of psilocybin compared to LSD and mescaline. The results confirmed what had already been common knowledge among those who used the mushrooms in various contexts around the world: "flashbacks" are quite rare, and very mild, if they occur at all, nor do abnormal symptoms persist

once the effects of the alkaloid have worn off. Widespread reports of LSD-induced "flashbacks" spawned biochemical theories which falsely postulate that LSD is stored inside the body and can be released at a later time to induce short periods of visions and other "psychotic" manifestations. Such conjecture about the body's "storage capacity" persisted despite prior evidence to the contrary that established LSD as a substance rapidly metabolized and eliminated from the body.

The assumption of a prolonged storage period following ingestion of LSD had already been debunked by LSD-assisted psychotherapy during the 1960's. According to M. Hausner, who worked in the former Czechoslovakia, several patients who went through a series of LSD sessions did experience "flashbacks" in between sessions. However, the therapeutic administration of hallucinogens was continued in these cases and those flashback episodes that did occur were far less spectacular than expected based on some of the more dramatic descriptions of the phenomenon. Within the context of M. Hausner's studies, flashback episodes turned out to be merely temporary manifestations of issues that had reached the conscious mind. Moreover, flashbacks disappeared as therapy progressed with continued administrations and did not recur after conclusion of the therapy program. These observations are at odds with the biochemical theory which predicted that repeated administrations would increase storage of the substance inside the body, causing increasingly powerful flashback episodes.

Considering the highly variable nature of psilocybin's effects as illustrated by examples of unintentional and carefully controlled experimentation described in this book alone, some striking parallels with Grof's findings on the effects of LSD virtually suggest themselves. Grof noted the emergence of, in that order, abstract, aesthetic, psychodynamic, perinatal and transpersonal types of experiences during hallucinogenic sessions. With repeated administrations of relatively low doses, participants typically progressed through these stages one by one, eventually attaining and lingering at the transpersonal level of analysis.

The accounts of psychoactive mushroom experiences included in this book are by necessity limited to only one to three trials over time. Thus, detailed analyses comparing the effects of LSD and psilocybin must await results from future research efforts, assuming researchers will be able to conduct these types of studies.

By contrast, relatively high doses of LSD as well as psilocybin typically "bypass" the initial phases of experience, propelling the individual directly into the realm of transpersonal consciousness. The natural scientist's first experiment with *Psilocybe bohemica* or the incidents of accidental intoxication with *Psilocybe cubensis* in Africa both illustrate these kinds of transpersonal experiences.

Aside from psilocybin's psychotherapeutic applications as detailed in Chapter 9, there are other interesting phenomena and potential uses for psilocybin as well as those mushrooms whose active ingredients can be analyzed and measured accurately.

The investigation of frequent symptoms such as compulsive laughter, yawning and the flow of tears without dysphoria may reveal interesting neurophysiological mechanisms, provided we can isolate and separate the influence of psychological factors in the manifestation of these symptoms.

Psilocybin as a Research Tool for Study and Diagnosis of Brain Damage

The benefits of diagnosing brain-damaged patients with psilocybin were investigated in the former Czechoslovakia during the 1960s. Psilocybin was the alkaloid of choice for these studies, due to its minimal toxicity and because participants were not expected to develop additional chronic dysfunctions as a result of ingesting psilocybin. Visual hallucinations were found to be almost completely suppressed in patients suffering from lesions to parts of the central nervous system known to mediate visual-sensory functions.

On the other hand, the discovery that psilocybin tended to potentiate a variety of neurological processes effectively turned the alkaloid into a diagnostic tool used to reveal latent paralyses and other subtle types of damage to the central nervous system. While LSD could also have been used for this purpose, researchers preferred psilocybin, because dosage measurement was comparatively simpler, its effects were

short-term and patients experienced less fatigue with psilocybin than with LSD.

In one exceptionally remarkable case, *one of the participants, while under the influence of the substance, clearly saw a brain tumor inside her skull - a tumor that was not discovered until an examination that followed the session.*

R. Fischer (see Figure 61) conducted a series of controlled experiments *involving the presentation of words and sentences composed of incomplete letters, with increasingly larger portions of the letters covered in several stages, from the top down. In the end, only the stumps of the letters remained in the display, which was no longer readable. Under the influence of psilocybin, however, the ability to "re-synthesize" these characters was observed quite frequently: Participants were able to read a significantly larger number of words, with some reportedly able to see the partial letters, complete and uncut, in a display that showed little more than a white background area.*

These observations are powerful evidence confirming that the effects of mushroom ingredients are certainly not just "psychotic" in nature, a notion preferred by those pharmacologists partial to terminology such as "toxic psychosis", with all its connotations as evoked by the "fool's mushroom" label. Psilocybin and its relatives apparently act as catalysts that initiate new information processing mechanisms and patterns of coordination between the different interactive areas of the brain. As such, the substances create the context needed for integrating emotional and rational processes in new ways. Under the most favorable of circumstances, such states of mind are experienced not only as a profound, impressive expansion of one's consciousness, but may also be reflected in short-term improvements of performance. I believe, however, that these temporary gains in skills are rarely attained by casual or recreational users of psilocybin-containing mushrooms, because set and setting are often less than ideal, and alkaloid content tends to be highly variable. Most researchers, including A. Hofmann, strongly advised against usage of hallucinogens by youngsters, even in controlled experimental settings. Adolescence is a time of upheaval, a developmental stage when youngsters struggle with themselves and their surroundings, searching for a purpose and a firm direction in life: Numerous conflicts arise in the process and need to be dealt with and integrated. Besides inducing altered perceptual states, hallucinogenic substances, including psilocybin are bound to release a stream of new emotions and conflicts. Such experiences often serve to confuse teenaged users and to compound existing areas of conflict, threatening to disturb the youngster's equilibrium, which is rather fragile tc begin with.

Quite likely, the search for a means to escape reality plays an important role in this situation. In fact, the escapist aspect of LSD portrayed against a backdrop of political upheaval fuelled a reactionary zeal among those determined to control the substance during the 1960's. As a consequence of these restrictive legislative measures, the unbiased, scientific evaluation of hallucinogenic substances remains an all but impossible task. These examples from the LSD research literature suggest that controlled human subjects research is possible without risking damage or injury to the participants, while gaining a wealth of new insights beyond psychotherapy applications.

Comprehensive investigations of these substances have long ago proven beyond doubt that psilocybin, mescaline and LSD are not physically addictive, nor do they cause withdrawal symptoms of any kind. Repeated self-experimentation over long periods of time is rare; most long-term users eventually reduce frequency of use due to the nature of these substances that initiate powerful transpersonal processes and facilitate the emergence of personal conflicts. Besides, habitual daily users quickly develop tolerance to the point of being unable to experience any psychoactive effects at all. That is why clinical trials are spaced to allow for intervals of at least one week between repeated applications.

Ecstasy is More than Entertainment

Renowned pharmacologist R. Siegel described hallucinogenic mushroom consumption in California as merely "experimental use". According to his definition, almost all users of psychoactive mushrooms have anywhere from at least one up to 10 experiences, with several weeks or months in between repetitions. Or

consider R. G. Wasson's poetic answer to a question from his banker friends who wanted to know why he did not eat the mushrooms every day:

"There are many who never experienced ecstasy and who may think this is entertaining. But ecstasy is not a form of entertainment: trembles. What kind of person would think nothing of submitting to a sense of pure, absolute awe or of *floating through that doorway into the presence of the divine? Those who have never known ecstasy first-hand, distort the word each time they use it. We must comprehend anew the entire, frightening meaning inherent in this word.*

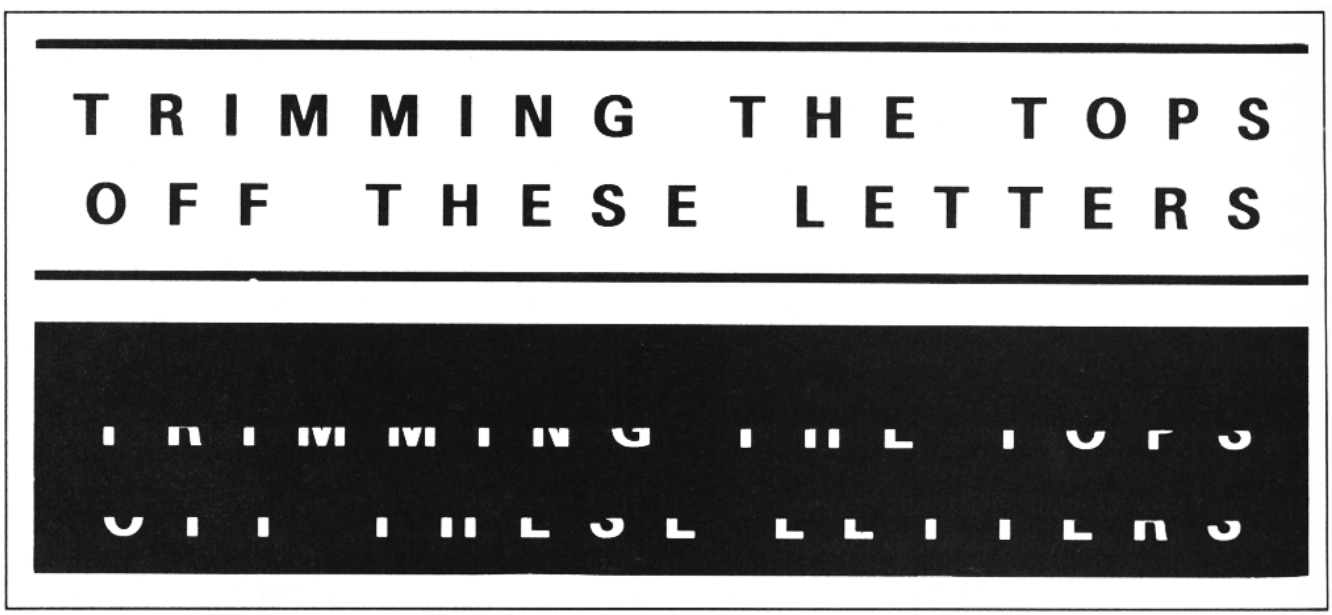

Figure 61 - "Letter Resynthesis" experiment by R. Fischer.

Figure 62 - "Peter Pan in Kensington Gardens".
Lithography by Arthur Reckham (London, 1890).

Figure 63 - *"Handing me one of the halves, he spoke the single word, drink. "* From *Etidorhpa* by J.U. Lloyd (1904).

CHAPTER 9

PSYCHOTHERAPY

We live in an era of profound sociocultural changes, while a growing sense of insecurity pervades many areas of our lives. At the same time, our achievement-oriented society has fostered a set of values propagated by industrious, hard-working and successful citizens. Naturally, not all members of society are able to embody these ideals or embrace them all the time.

Psycholytic Therapy

Oftentimes, the origins of chronic neuroses are rooted in early childhood. Neurotic behavior can evolve under a wide variety of circumstances that include combinations of unfortunate personal and social conditions. There are numerous forms of neuroses and symptoms can vary considerably. Neurotic disorders afflict a large segment of the population, significantly impairing their quality of life.

According to the various schools of traditional psychoanalytic thought, the dissolution of neuroses is a lengthy process, whose progress depends on penetrating layers of "character armoring" and identifying the root causes of unhealthy fixations. Hoping to shorten the duration of treatment by accelerating the pace of resistance dissolution practitioners, have turned to pharmaceuticals as an adjunct to the therapeutic process. Thus, upon discovery of the unique properties of hallucinogenic agents during the 1950's, LSD gained widespread popularity as a therapeutic agent, while mescaline remained obscure, as it was used by comparatively few practitioners. Patients under the influence of these substances confronted long repressed traumatic events as they began to surface and enter conscious awareness. In some cases, such emerging traumatic experiences had been repressed since early childhood. Medical records and case histories indicate that many patients not only remembered, but actually relived traumatic experiences in their past.

At this point, I would like to summarize the major elements of this psychotherapeutic approach, based on the excellent books written by H. Leuner, S. Grof and S. Widmer. From a variety of different perspectives, these authors thoroughly examine the therapeutic process, drawing on extensive clinical expertise representing decades of experience in several countries.

At times, critics from within the psychiatric establishment have claimed that a "short-term high" is simply not capable of propelling complex processes into conscious awareness, and that psychoactive substances are no short-cut to quicker treatment. These are weak objections at best, because we already know that the awesome intensity of an unfolding psychedelic episode is sufficiently powerful to propel individuals towards gaining valuable insights of a highly personal nature (see accounts in Chapter 3.2). Such landmark experiences are likely to stand out as significant personal milestones whose impact will not diminish for many years, even if the individual never uses the substance again. On the other hand, due to the profound, far-reaching nature of the psycholytic process, skillful and responsible guidance is crucial to preventing the genesis of new sets of neurotic symptoms. Whenever a new therapy is adopted, occasional mistakes are not uncommon during the initial phases. The medical use of hallucinogenic substances was no exception. However, our knowledge base and expertise on essential practical procedures has grown considerably since the pioneering days of psycholytic therapy. Having learned from initial errors, we can now prevent problems and avoid mistakes.

Psilocybin as the Drug of Choice

Following its initial isolation and discovery of its chemical structure, psilocybin quickly joined the group of hallucinogens used in

therapeutic settings. The alkaloid was considered to be quite safe, based on existing toxicological data. H. Leuner still considers psilocybin the most effective alkaloid for use as a pharmaceutical aid in psychotherapy, despite recent progress in developing other substances designed for therapeutic applications, such as the substituted phenethylamines like MDMA. Psilocybin's reputation as a substance well suited for psychotherapeutic applications is related to its extremely low toxicity. Most importantly, dosages below the 10 mg threshold can be measured with accuracy. This is significant, because dosages of up to 10 mg are not only known to be therapeutically efficient, but effects within this dosage range can always be brought under control. The states of consciousness induced by psilocybin last only five hours, on average, and thus can be more conveniently utilized than altered states caused by LSD, whose effects persist for much longer time periods. LSD should be considered a more difficult substance to work with, due to the possible emergence of unwanted symptoms in a small percentage of users and the prolonged process of "coming down" when symptoms subside. Unlike other hallucinogens, psilocybin also has the advantage of almost never inducing "hangovers" the day after experimental sessions.

It is important to note in this context that all authors stress that hallucinogens are no substitute for lack of skills on the part of the therapist and that the usage of these substances should remain limited to carefully selected cases. Usage of hallucinogens "merely" shortens the duration of psychoanalytic treatment, as problem conflict areas surface faster and with greater clarity, mediated by the process of selfexploration and discovery that is the essence of psychedelic experiences. Repressed patterns of normal behavior and reactions must be gradually re-constructed within the therapist-patient relationship.

The capacity for emotional immersion into one's own problems under the influence of a psychoactive substance is provoked and amplified by the emergence of memories, as well as the elimination of the Me/You boundary. As this process unfolds, the therapist gains valuable insights into existing psychopathologies and psychodynamics. Still, in addition to providing proper guidance for the patient, the therapist must also be able to separate bizarre forms of alienation that may appear from the emerging conflict matter.

The Language of Statistics

According to statistical data, psycholytic therapy is a remarkably efficient form of treatment, most notably in patients suffering from neuroses. A follow-up study of 82 patients showed that 65 % of them showed long-term, clinically significant improvement. In all, 28 authors described 1,600 therapy cases, covering 42 investigations that took place from 1953 to 1965. The course of illness was judged very grave and chronic in 68 % of the cases. The dministration of hallucinogenic substances within the psychotherapy setting resulted in success rates of up to 70% ("good and substantial improvement"), especially in the treatment of neurotic anxieties, depressive-neurotic dysphorias as well as neurotic character disorders.

In the former Czchechoslovakia, M. Hausner also tested *Psilocybe bohemica* for psycholytic therapy sessions, with successful outcomes comparable to those observed following administration of LSD. For many years up until 1974, Hausner has used LSD with more than 350 patients in about 3,000 sessions. In Mexico from 1967 until 1974, S. Roquet developed an interesting modification of the therapeutic technique ("psychosynthesis") where hallu-cinogens are used as an adjunct to the therapy process. His conceptual approach was strongly influenced by the shamanistic uses of different substances in his home country. Groups of 10 to 20 people experienced effects of a diversity of substances (psilocybin mushrooms, peyote, LSD, ololiuqui). While stereo music played in the background, several slide and film projectors were used to present images whose emotional content ranged from pictures of love to scenes of horror. Thus, in addition to hallucinogeninduced emotional stimulation, patients are also exposed to powerful external stress factors, modifying the experience into one of a very deeply emotional nature. Duration of treatments varied from 18 months up to two years, with many hours of drug-free therapy and, on average, one hallucinogen-assisted session a month. On a few occasions, patients received the substance in

individual settings. Roquet reported successful treatment of neurotic character disorders in 85 of the patients. The psychoanalytic and transpersonal elements of a substances' effects were considered therapeutic agents, supported by sustained positive feelings among group session participants.

The Conquest of Fear in the Face of Death

During the 1960's and 1970's, most therapists in Europe were limiting the scope of their work by exploring only the psychodynamic level of behavior. Elsewhere, however, practitioners of hallucinogen-assisted therapy dispensed large doses of psychoactive drugs, maximizing the emergence of transpersonal states of consciousness that often resembled mystical experiences. These episodes of transpersonal transcendence ("psychedelic therapy" in the U.S.) contribute to the therapeutic process; they may even be the sole source for future progress.

Under these conditions, stereo music also significantly deepened the intensity of the experience. It appears that these kinds of specific experiences may also account for the remarkable success of treating terminal patients with LSD to ease their fears in the face of death and to reduce even the most severe forms of pain. In many such cases, symptoms disappeared entirely, and relief from pain and anxiety that continued even after the drug's acute effects had worn off. A book by S. Grof provides a compassionate analysis of such successful treatments, which serves to underscore the fact that systematic efforts to investigate these particular therapeutic benefits have only just begun. So far, LSD has been the most widely studied substance in terms of easing the suffering of terminally ill patients, as well as dipropyl-tryptamine (DPT), a synthetic drug structurally similar to psilocybin that is active only when administered by injection.

Below, a young woman from Switzerland gives a detailed account of her second mushroom experience. Her first experiment, with *Psilocybe cubensis,* had already introduced her to the realm of mystical experiences. For her second journey, she used 20 *Psilocybe semilanceata* mushrooms as part of a group ritual and achieved transcendence. A remarkable feature of her account is that the presence of an experienced guide was needed to realize the full potential of this visionary quest.

"I sat down next to another participant, seeking to connect with others in preparation for my journey. We proceeded to eat the fresh mushrooms. The room grew quiet and lovely music began to play. The mushrooms's effects came on much faster than they did during my first experiment. Twice I tried to establish closer contact with my fellow participant, but he was very nervous, and no source of reassurance for me. I was seeking my spiritual companion, but did not find that person among the present group. I became a figure in a long, white robe, wandering aimlessly among the columns (Greece?), still searching.

My gaze lingered briefly on the wall next to the door and I saw faces and figures appear and vanish, but they did not hold my interest. It was hopeless. I continued my aimless roaming, and I was on the material plane, which I wanted to leave - had to leave. Suddenly, I found myself with one of the guides, who wanted to help me. I stared off into the distance, longing to be free of the material plane, but unable to do so. For a long time, I failed to connect with the guide; our two worlds were just too different. Suddenly I sensed that he wasn't able to look at me directly. The path by which to reach me runs through my eyes, because only they are truly alive. I asked him to help me on my way and invited him to look into my eyes. I felt as if all life energy was draining from my body and my breathing became erratic. My body contracted, struggling to cast off its worldly shell. The guide began to talk to me in a calm and quiet voice, then laid back down and stroked my right arm. Quite suddenly, I felt at peace. I took a deep breath and relaxed. The guide said that it's alright, to just let go, to give up my resistance. The goddess awoke and told him that he is the one resisting. Why? Didn't he want to learn anything about me? I smiled the goddess's smile and had become her, as he replied that he was afraid of my eyes, because they appeared so bottomless and dark that he feared losing himself in them. I answered that I was dangerous, the Goddess Kali the Terrible, a man-eater, and that he should look at me and enter. My gaze penetrated him into eternity; a connection had finally been established. His face turned green, covered with

moss and I saw horns. It was a kind face, yet full of cunning, a little devil's face, like Pan's. At times, stripes streaked across his face; I had become a seer.

I saw a child, a young man with blond hair cropped just above his shoulders, ca. 17th century. He is busy writing, inside a small house located in a city; a poet perhaps, or a scribe? Germany or Holland? This was a state of infinite harmony, a light that seemed to come from everywhere and nowhere at all; something that had always been there and always will be, something that simply exists. There is no past and no future. Consciousness beyond body and barriers, infinite, all-consuming; an infinite, universal love that embraces everything. I had a strong sense of agelessness, because I embodied a principle that had always existed. How intensely I felt these unearthly emanations, this very eternity. I saw through what appeared to be a succession of many caves, through myriad dimensions, and all of them were flooded with light - my energy. An energy existing simultaneously at its source as well as throughout eternity. This was a plane of utter harmony, devoid of contrasts such as good and evil, marked by the overwhelming peace of a spirituality both cosmic and infinite. The Goddess smiled. I no longer existed as a woman and as such could not be reached by others.

After that, the effects began to subside slowly. In the presence of my guide I felt infinite protection and total understanding. Under his guidance and protection, I began to ease into the slow and gentle descent back to my earthly state of being. In the process, I found myself able to switch back and forth repeatedly between both states of consciousness. I realized that even my deepest agonies had become insignificant over "on the other side ". Furthermore, I understood that all the religions with their sets of rules had been created at one time or another for the sole purpose of providing guidelines for humanity, yet excessively narrow interpretations of these rules have rendered them all but irrelevant. Anyone who embarks on a deliberate search for a higher harmony, seeking spirituality, has no need for such rules at all. "

It is instructive to consider some of the comments made by R.G. Wasson's wife Valentina Pavlovna, as they appear in the second report about Mexico's magic mushrooms in 1957, written in the wake of experiencing the impressive effects of her self-experiment. A medical doctor by profession, V. Pavlovna brought up the potential for medical applications, given successful isolation of the active mushroom ingredient. According to her writings from that period, she believed the substance to become a significant new tool in the study of psychic processes, that it would benefit the treatment of alcoholism, drug addiction and mental problems, and help ease the suffering of terminally ill patients with severe pain. It was several years later that a number of researchers, unaware of V. Pavlovna's article, began to treat these very same conditions with LSD, a substance that is much harder on the patients' systems than psilocybin!

The medical use of psilocybin, a basically non-toxic substance, as well as mushrooms with known active ingredients, should, in my opinion, be permitted with terminally ill patients. The promise of easing the suffering of dying patients alone should be reason enough to allow the use of psilocybin and related substances, considering the reality of fatal illness as one of the grimmer universals of human existence. Many psychiatrists and pharmacologists maintain that the mystical aspects of hallucinogenic substances should be described more accurately as psychotic in nature, and that repeated manifestations of these symptoms are cause for worry and concern, since their existence and nature cannot be explained. The convictions behind these beliefs, however, pale compared to the promise of being able to provide that which strikes at the very essence of practicing medicine: to help patients endure the ultimate anguish of impending death, while making sure they are not left alone to deal with pain and fear.

Scientific Research Under Fire

It was about 30 years ago that legislation was enacted severely restricting the use and availability of hallucinogens. It is most unfortunate that these sweeping prohibitions dealt a crippling blow to legitimate research efforts, forcing more and more investigators to abandon this area of study. Thus, despite the success of psycholytic therapy, its practice was discontinued during the 1970's. In retrospect, a calm and pragmatic analysis of these events can surely help us recognize that those years of pioneering

research laid the foundation for the development of a whole new form of treatment - one that has already proven effective in aiding the healing process and relieving the symptoms of hundreds of gravely ill patients in various countries around the world. In many cases, improvement occurred after all previous methods of treatment had failed completely. Today, we are faced with a situation so bizarre it defies reason and logic: the entire pharmacological class of hallucinogens is subject to even more severe taboos than truly addictive substances that do have legitimate medical uses, such as the morphine-type drugs and their derivatives.

H-Bomb for the Soul?

The irrational fears surrounding the "proper functioning" of our consciousness were responsible for the genesis of two very extreme views about LSD during the 1960's, dating back to the earliest phases of research into this substance. Proponents praised LSD as a "miracle drug", while its detractors were quick to brand LSD the "devil's drug" (or "an H-bomb for the soul"). It was the latter group that prevailed in the end by way of political power.

This controversy, already a matter of historic record, has been marked by a pattern of confusing emotion with scientific standards. Today, we are surely capable of overcoming past controversies, by embracing a rational approach to resolving problems and issues of contention. Viewed objectively, an unbiased assessment of hallucinogen-assisted psychotherapy is possible only in terms of measuring success. In order to do this, however, we must be allowed to use these substances in therapeutic and unbiased scientific settings.

There is some hope that current lop-sided attitudes against hallucinogens may be changing for the better, as efforts by the Swiss Medical Society for Psycholytic Therapy to re-legitimize hallucinogen-assisted therapy have met with modest success. In 1988, the Swiss gave permission to a few selected psychotherapists to use psychoactive substances for psychotherapeutic purposes, at least within a narrow range of strictly defined conditions and for a limited time. Thus, legal psycholytic therapy in Switzerland continued until 1993, with efforts to renew the permit currently underway. Thus, we can hope that in the future, psychedelics-assisted psychotherapy will experience a similar renaissance in other countries as well. If so, psilocybin is likely to stand out as the most valuable and beneficial substance, as well as the least risky among the group of possible substances that may be used in this context.

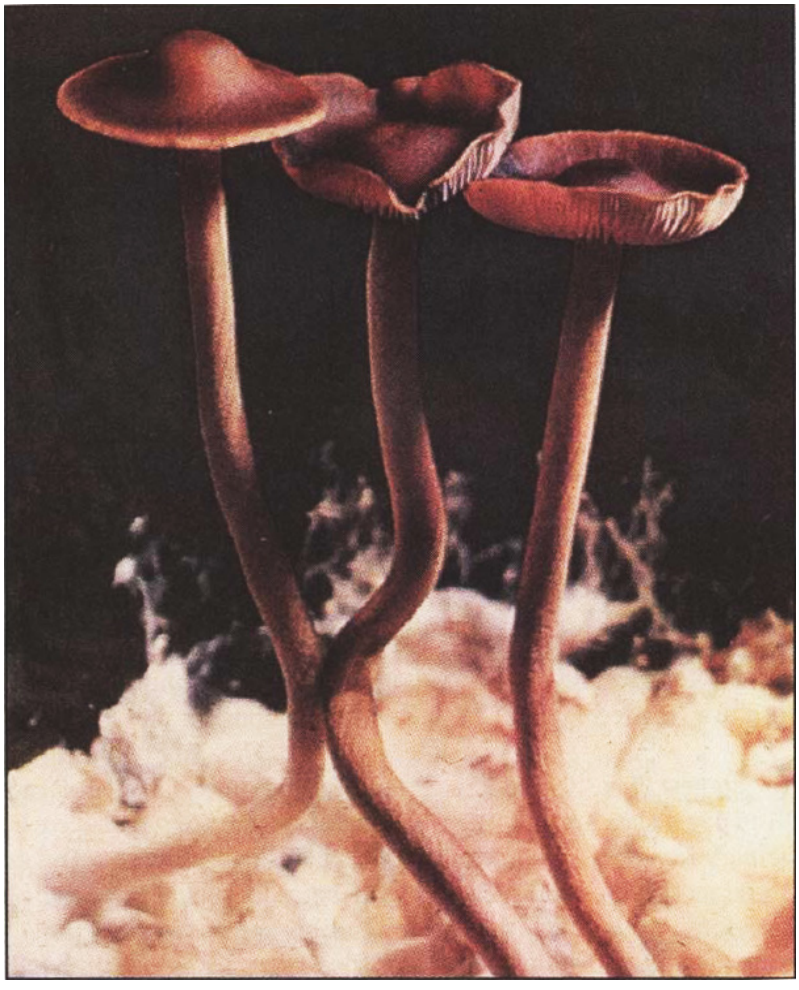

Figure 64 - Laboratory culture of *Psilocybe mexicana Heim*.

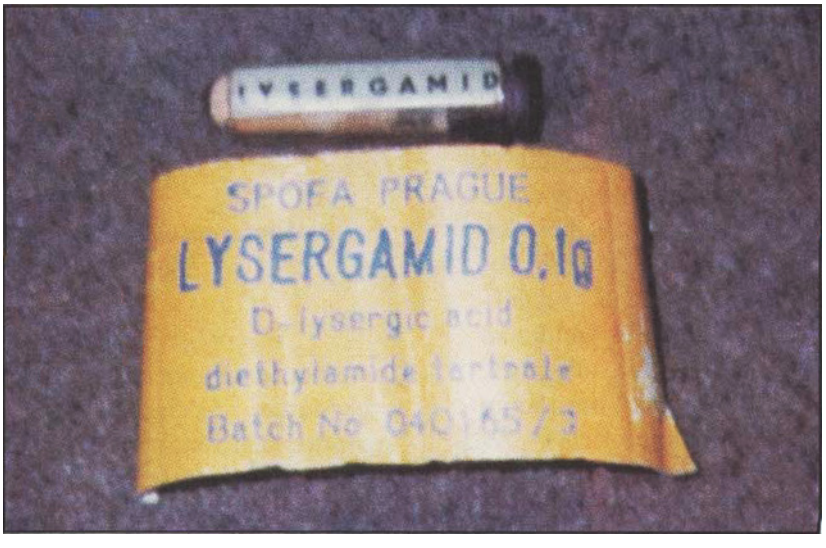

Figure 65 - Vial of pharmaceutical LSD with

CHAPTER 10

OUTLOOK

Apparently, all of the most important psilocybin-producing European mushroom species are already well known. Their geographic distribution and migration patterns, however, have not yet been adequately investigated. This knowledge gap primarily applies to recently discovered species outside the *Psilocybe* genus. In addition, there is a lack of comprehensive sources of information on distribution patterns of *Psilocybe cyanescens* for a number of different countries.

More Taxonomic, Ecological and Chemical Data are Needed

I would like to suggest that, for most species, even chemical analysis data should be viewed as merely preliminary in nature. In order to learn the truth about these mushrooms and such issues as prevalence, migrations into new habitats, specific positions within the mycological system as a whole, or chemo-taxonomical concerns, we must first acquire more taxonomic, ecological and chemical data from the study of relevant mushroom species. While further analysis of fruiting body samples from known species in order to determine alkaloid content variability remains an essential task, future research must also include efforts to identify secondary substances, as well as their structural isolation. Baeocystin, for example, appears to be an alkaloid primarily found in mushrooms from temperate climate zones, and it is less common in tropical species. Today, there are substantial doubts over whether the synthesis of Baeocystin as described in 1988 is actually feasible. There is an urgent need for additional research on the synthesis of this substance. Possibly, a number of different mushroom ingredients may have psychotropic effects. As such, they could act as modifiers of psilocybin's primary effects in various ways. For instance, accounts of mushroom usage from ancient Mexico already included observations about different types of effect associated with the various mushroom species in use. Perhaps these distinctions are not just the result of different concentrations of psilocybin and psilocin. Moreover, among European and North American mycophiles, the vast majority stress the popularity of *Psilocybe semilanceata,* a species favored over all others, because of its reputation for causing the "richest" kinds of experiences. Indeed, analyses of *Psilocybe semilanceata* extracts typically confirm the presence of eight indole compounds, whereas other species, such as *Psilocybe cubensis,* usually contain only half as many. Understanding just how such ingredients interact with psilocybin may well result in the development of new clinical applications for these substances.

The mycological literature includes information about several rare, if "questionable", species, some of which have been reported to show blue discolorations. The *Mycena* and *Pluteus* genera, for example, include descriptions of such mushroom species. If indole alkaloids were to be found in mushrooms other than the *Agaricales* (gilled mushrooms), it would mean a sensational discovery. Future chemical analyses are bound to identify additional psilocybin-producing mushrooms among the European species, which number about 5,000. There is an even greater likelihood of discovering alkaloids in many nonEuropean species, as the mycofloras of most countries have not been researched as extensively as Europe's.

Understanding the Mushrooms' Powerful Magic

Ethnopharmacological research efforts are also bound to generate remarkable results in the near future. G. Samorini, for instance, recently reported that Catalonia, Spain, is a region where *Psilocybe semilanceata* has traditionally been known by the unusual name of "sorgin zorrotz", or "witches' tread". This label strongly suggests early ritualistic usage of *Psilocybe semilanceata* in that area. Interestingly, Catalonia is also known as

Europe's only region where traditional usage of *Amanita muscaria* has been confirmed. In addition, there is growing evidence that other world religions, especially in Africa, have embraced the usage of psychoactive mushrooms as well, an intriguing possibility that calls for further study.

While the number of psychotropic mushroom species has risen dramatically all across Europe, the pace of progress in developing medical uses for mushroom ingredients has not followed suit. However, hallucinogens, including psilocybin have a history of therapeutic usage, a practice that is documented by a great deal of information, experiences and insights.

Given the lack of alternate methods to study these substances, the revival of medical and interdisciplinary research efforts is a more crucially important issue now than ever before. After all, a better understanding of psychotropic substances may well benefit a vast number of patients, possibly by contributing to the processes of mental and psychic healing. A glimmer of hope for the revival of large-scale research comes from the United States, where a very small number of investigators have, on occasion, succeeded at securing government permission to conduct studies on the medical aspects of hallucinogens, including psilocybin. The conceptual approach behind the design of these research projects suggests that virtually no reliable pharmacological data is in existence. In fact, these substances have undergone extensive study over the course of several decades. To the extent that relationships of dosage and effects have already been determined, current and future research efforts should build upon existing knowledge, instead of neglecting or ignoring previously published results. High-tech methodology may well yield new results - techniques for exploring and enhancing our understanding of mushrooms at the biochemical level. But increased biochemical knowledge does not permit us to draw any sort of conclusion about other aspects of psychoactive substances, such as psychedelic peak experiences, exploring the realms of the subconscious mind, as well the development of therapeutic applications based on these effects.

Certain hypnotherapy techniques are known to induce experiences similar, but not identical to, those caused by administration of hallucinogens. Recent studies have demonstrated that hypnosis can benefit the immune system, a finding that suggests psilocybin and related compounds may have potentially similar properties. Meditation and dreaming are additional examples of states of consciousness with interesting parallels to psychedelic experiences, yet very little is known about these links, due to the scarcity of research efforts in this area.

In recent years, the non-medical use of psychotropic species has become an increasingly popular pastime. I agree, however, with the assessment of Swiss toxicologist R. Flammer, who has written about the possible problems linked to this practice:

"....There is no need to panic, considering the severity of existing problems with alcohol and hard addictive drugs, which make the Panaeolus mushrooms and their close relatives appear harmless by comparison. "

In order to guard against being dazzled or overwhelmed by the mushroom's powerful magic we must embrace the pursuit of in-depth research into hallucinogenic mushrooms, a method that can protect us from jumping to conclusions, and in the process, from hampering the advancement of beneficial applications.

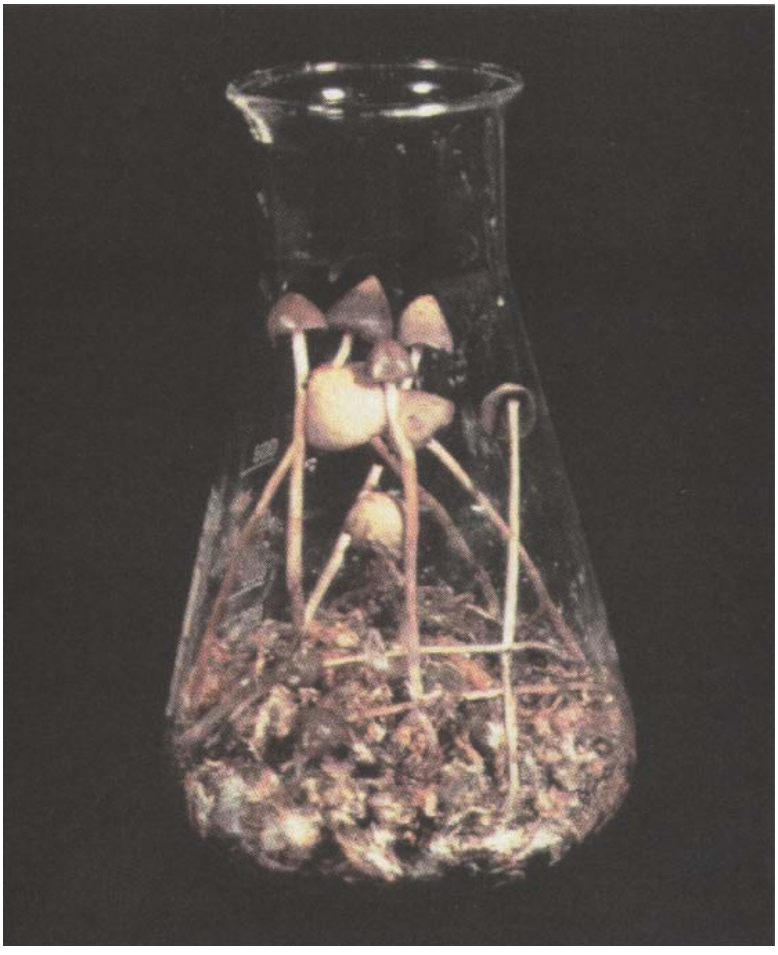

Figure 66 - *Psilocybe semilanceata* cultured on a mixture of grass seeds, dung and grains of rice.

Figure 67 - *Psilocybe semilanceata* at a natural location in Austria.

Figure 68 - *Inocybe aeruginascens* fruiting bodies at a natural location.

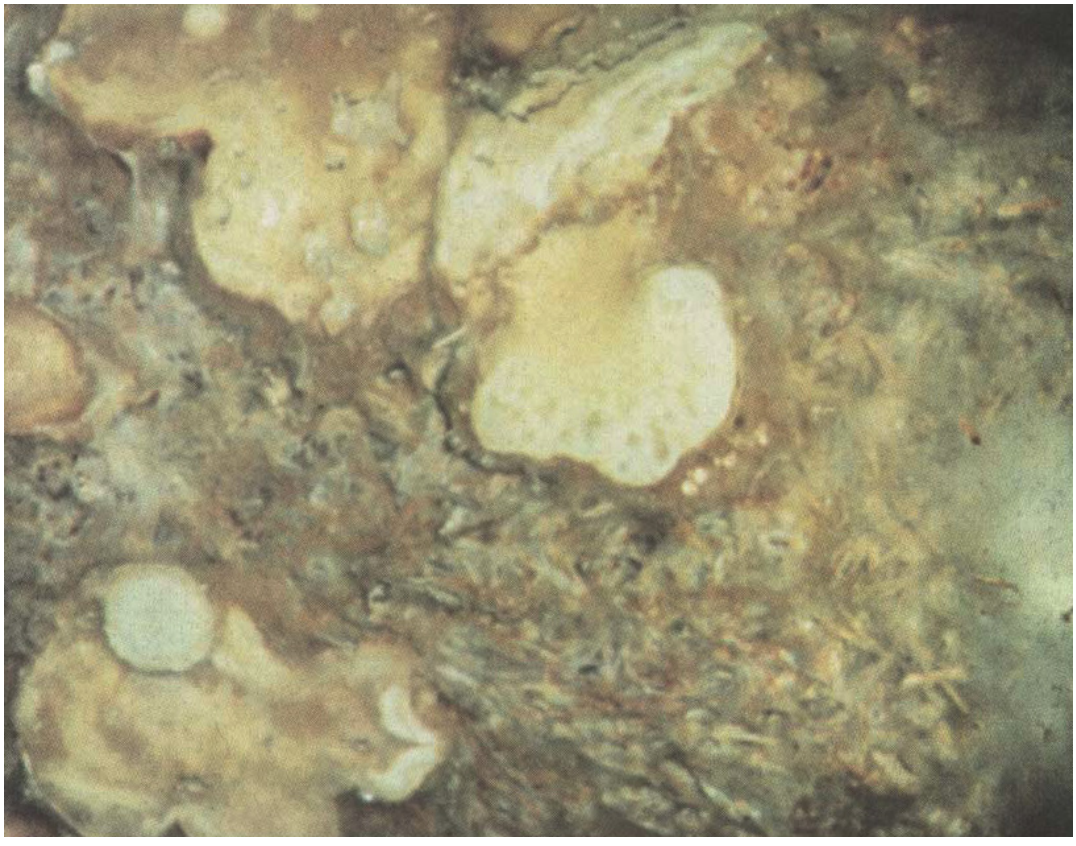

Figure 69 - *Psilocybe tampanensis* sclerotia on lolium seeds.

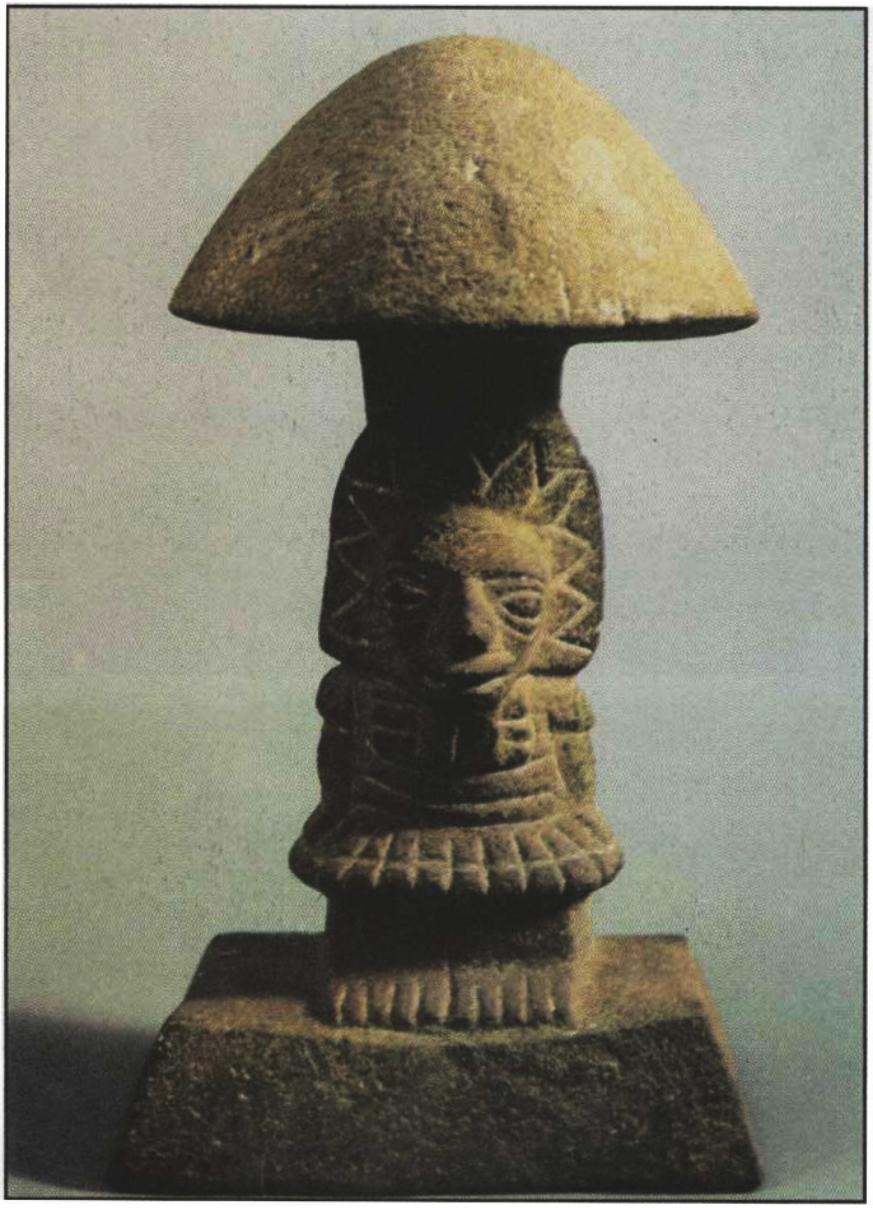

Figure 70 - Stone sculpture of a mushroom deity from the classic period of Mayan culture (300-600 A.D.). Statue is about 12 in. tall. (Rietberg Museum, Zurich).

Figure 71 - *Psilocybe stuntzii* on mulch (Northwestern United States).

Figure 72 - *Psilocybe baeocystis* from Seattle, USA.

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Considering the vast amount of relevant mycological literature, it makes sense to subdivide citations into categories representing distinct subject areas and specific species and genera. While some entries deal with more than one mushroom species, they are listed only once, under the category heading of the species that is the main focus of the work cited. This will aid in locating citations about specific species, as well as those with a more generalized scope, since titles alone often do not accurately reflect overall content or specific emphases.

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